



UNIVERSITY
OF TASMANIA

THE ROLE OF MALAYSIAN DRY PORTS IN THE CONTAINER SEAPORT SYSTEM

By

JAGAN JEEVAN

B.Sc. (Maritime Management), M.Sc. (Port Management)



**Department of Maritime and Logistics Management
National Centre for Ports and Shipping
Australian Maritime College
University of Tasmania**

**Submitted in fulfilment of the requirement for the degree of
Doctor of Philosophy
University of Tasmania
11th July 2016**

DECLARATION OF ORIGINALITY

“This thesis contains no material which has been accepted for a degree or diploma by the University or any other institution, except by the way of background information and duly acknowledged in the thesis, and to the best of my knowledge and belief no material previously published or written by a another person except where due acknowledge is made in the text of the thesis, nor does the thesis contain any material that infringes copyright.”

Jagan Jeevan

Date: 11th July 2016

STATEMENT OF AUTHORITY OF ACCESS

This thesis may be made available for loan and limited copying and communication in accordance with the *Copyright Act 1968*.

Jagan Jeevan

Date: 11th July 2016

STATEMENT REGARDING PUBLISHED WORK CONTAINED IN THESIS

The publishers of the papers 1 to 3 (comprising Chapter 4,6,7 and 8) are located in Appendix F) hold the copyright for that content, and access to the material should be sought from the respective journals. The remaining non-published content of the thesis may be made available for loan and limited copying and communication in accordance with the above Statement of Access and the Copyright Act 1968.

Jagan Jeevan

Date: 11th July 2016

STATEMENT OF CO-AUTHORSHIP

The following people and institutions contributed to the publication of work undertaken as part of this thesis:

Title of paper 1: The development of Malaysian dry ports in the container seaport system

Jeevan, J., Chen, S. & Lee, E. 2014, 'The development of Malaysian dry ports in the container seaport system', *Proceedings of the 2014 International Association of Maritime Economists Conference*, 15-18 July 2014, Norfolk, Virginia, USA.

Title of paper 2: The challenges of Malaysian dry ports development

Jeevan, J., Chen, S. L. & Lee, E. S. 2015, 'The challenges of Malaysian dry ports development', *The Asian Journal of Shipping and Logistics* vol. 31, no. 1, pp. 109-134.

Title of paper 3: Influential factors of Malaysian dry port operations

Jeevan, J., Chen, S. L. & Cahoon, S. 2015, 'Influential factors of Malaysian dry port operations', *Proceedings of the 2015 International Association of Maritime Economists Conference, The Role of Maritime Clusters and Innovation in Shaping Future Global Trade*, 24-26 August 2015, Kuala Lumpur, Malaysia.

Candidate was the primary author. Co-authors contributed to the idea, its development and assisted with the refinement and presentation of the work.

I, the undersigned, agree with the stated proportion of work undertaken for the published peer reviewed manuscript contributing to this thesis.

Dr. Shu-Ling Chen

Primary Supervisor
National Centre for Ports and Shipping
Department of Maritime and Logistics Management
Australian Maritime College,
University of Tasmania

Date: 5th July 2016

Professor Thanasis Karlis

Director of National Centre for Ports and Shipping
Australian Maritime College
University of Tasmania

Date: 5th July 2016

STATEMENT OF ETHICAL CONDUCT

The research associated with this thesis abides by the international and Australian codes on human and animal experimentation, the guidelines by the Australian Government's Office of the Gene Technology Regulator and the rulings of the Safety, Ethics and Institutional Bio safety Committees of the University.

Jagan Jeevan

Date: 11th July 2016

DEDICATION

To our beloved mother, who still lives *within* us,

Kannamal Subramaniam

17th January 1957-11th July 2015

ABSTRACT

The concepts of intermodal logistics and distribution networks have made integration of the inland freight distribution system essential for an efficient container seaport system. The inland components, such as dry ports, which exist within the seaport system, have become important in shaping the performance and competitive strategies of container seaports. In Malaysia, several dry ports have been developed and operated since 1984, but they have not been utilised well. The increase of container trade in Malaysian container seaports however has created an opportunity for dry ports to be a logistic node to facilitate container flows between inland and seaports. Owing to the importance of interdependence between dry ports and container seaports, research on dry port development and operations has increasingly drawn the attention of scholars during the last decade. Nevertheless there have not been any empirical studies undertaken in the Malaysian context, neither on how dry ports development enhances the competitiveness of container seaports. This thesis thus aims to investigate how dry port development in Malaysia has enhanced the competitiveness of the container seaport system.

This research has adopted a mixed method research methodology by employing semi-structured face-to-face interviews in the qualitative phase and online surveys in the quantitative phase. Face-to face interviews explored the role, objectives, functions, benefits, strengths and challenges of Malaysian dry ports in the container seaport system. A total of 11 interviews with seaport and dry port operators, government bodies, and the rail operator were conducted. The findings show that there are three major roles of Malaysian dry ports: as an extended seaport, as regional intermodal nodes and as an interface terminal inland. The primary objectives of dry ports are to accelerate national and international trade, activate intermodalism in the nation, improve seaport competitiveness, enhance regional economic development and establish Malaysian port policy. Malaysian dry ports also have several functions including logistics, transport, value adding service provision and administration functions to assist seaports and their clients. In addition to benefiting container seaports, dry ports provide benefits to users by reducing waiting times at seaports, providing clearance systems, reducing freight costs, facilitating cross border transactions and reducing empty container movements.

Other findings in the qualitative phase include discovering the strengths and challenges of Malaysian dry ports. These are location, involvement of the public and private sectors, and the availability of transport connectivity. Currently, however Malaysian dry ports are not being fully utilised owing to many challenges faced by them. These include issues related to transportation infrastructure and operation, container planning, competition, location and local communities. For executing their roles and functions,

Malaysian dry ports should possess sufficient operational infrastructure, professional personnel and capital infrastructure which can be harmonised with container seaports and other components within the container seaport system.

In the quantitative phase, the online survey aimed at examining factors influencing dry port operations and how these impact the competitiveness of container seaports. At this stage, hauliers, freight forwarders, shippers, shipping lines, seaport operators and the rail operator have been selected to participate in the survey. The EFA results show seven factors influencing dry port operations: information sharing, service features, capacity, government policy, hinterland conditions, location and administration. The results show that dry port operations have clear impacts on seaport competitiveness. These include enhancing seaport performance, increasing service variations for seaports, improving seaport-hinterland proximity, increasing seaport trade volume and enhancing seaport capacity. The outcomes also reveal that these seven factors affect seaport competitiveness by enhancing seaport performance, increasing service variations for seaports and improving seaport-hinterland proximity.

Malaysian dry ports have some opportunities for future development for the purpose of serving container seaport systems. These include the accessibility to international transportation networks and the availability of international and national economic development plans. The strategies for utilising the above opportunities are provided in this thesis, such as developing transport infrastructure, enforcing information sharing between key players, generating teamwork between seaports and dry ports, developing a network among the dry ports, location pooling, developing dry port marketing plans, introduction of safety and security systems in dry port operations, ensuring a balanced development in freight transport and others.

Academically, this research enhances the literature of dry port development in the Malaysian context. Furthermore, this research examined the relationship between dry ports and container seaport competitiveness. It validated the factors of dry port operations to seaport competitiveness. This research is a cross-sectional research combines two broad topics, dry ports and container seaport competitiveness, and comprehensive research on examining the relationship between dry ports and container seaport competitiveness. This research contributes to methodological development in dry port and container seaport competitiveness research by formulating the strengths of the qualitative method in developing a robust base for a quantitative approach. The contributions of this thesis relating to the methodological development of research on dry ports and container seaport competitiveness are threefold: the introduction of the mixed method research to maritime studies, the integration of qualitative and quantitative results in a single piece of research, and the development of an innovative methodology for dry ports and container seaport research.

From a managerial perspective, this thesis explicitly elaborates the roles, functionalities and objectives of dry ports in the Malaysian container seaport system. It helps to provide clear guidance for dry port stakeholders to be aware of the importance of Malaysian dry ports so as to utilise such intermodal terminals. Recommended strategies by this thesis provide references to policy makers and stakeholders for improving dry port operations, attracting more freight and enhancing seaport competitiveness.

ACKNOWLEDGEMENTS

Firstly, I would like to convey my unconditional gratitude to my respected primary supervisor Dr Peggy Shu-Ling Chen for her substantial guidance, constructive support, delightful attitudes and generosity. I really appreciate her care and concern during my research journey. Her opinions, knowledge, wisdom and ability to lift me up whenever I felt down have helped to bring out the best in me. Her guidance has made the journey of my PhD more valuable and all her deeds and sincere advice will always be remembered. I also would like to thank Dr Stephen Cahoon, my secondary supervisor, for his positive guidance during my candidature. I am thankful for his guidance.

I am truly thankful to Prof. Saharuddin Abdul Hamid, former Dean in the Faculty of Maritime Studies and Marine Science, University Malaysia Terengganu and all members of the Department of Maritime Management for their supportive encouragement. I wish to thank the Ministry of Higher Education of Malaysia for their support throughout my journey.

I am thankful to Dr Benjamin Brooks, Dr Hong-Oanh Nguyen, Dr Eon Seong Lee, Dr Hilary Pateman, Dr Jiangang Fei, Dr Hossein Enshaei and Mrs Lindsey Steers for their support during my research.

Special thanks go to my research colleagues including Dr Yapa Bandara, Dr Quazi Sakalayan, Dr Hadi Ghaderi, Livingstone Caesar, Dr Cecile L'Hermitte, Dr Lokman, Dr Melissa, DrJacky Elizabeth, Ms Reenu and all researchers at the AMC research hub for making this journey more effortless.

My special appreciation goes to my mother Kannamal Subramaniam, my father Jeevan Thannimalai, my brother Jayan Jeevan, my sister Prabavathi Jeevan, my brother-in-law Ragu Muniandi and my son Jeev Jagan for their unconditional love, magnificent faith, endless guidance, being supportive during tough times, unending encouragement, and being helpful during my PhD journey. This research would not have become reality without the support of these wonderful people. **THANK YOU**....from the bottom of my heart.

LIST OF ABBREVIATIONS

AHN	-Asian Highways Network
AMC	-Australian Maritime College
BIMP-EAGA	-Brunei-Indonesia-Malaysia-Philippines-East Asian Growth Area
BKE	- Butterworth-Kulim Expressway
BPA	-Bintulu Port Authority
CCTV	-Closed Circuit Television
CDP	-Cikarang Dry Port
CEO	-Chief Executive Officers
CFA	-Confirmatory Factor Analysis
CFS	-Container Freight Stations
CONCOR	-Container Corporation of India Ltd.
ECER	-East Cost Economic Region
EDI	-Electronic Data Interchange
EFA	-Exploratory Factor Analysis
E-SCM	-Electronic Supply Chain Management
ETA	-Estimated Time Arrival
ETD	-Estimated Time Departure
FDT	-Association of Danish Transport Centres
FIP	-Face To Face Interview Participant
FTZ	-Free Trade Zone
ICD	-Inland Container Depots
ICT	-Information Communication and Technology
ICT	-Ipoh Cargo Terminal
IM	-Iskandar Malaysia
IMS-GT	-Indonesia-Malaysia- Singapore Growth Triangle
IMT-GT	-Indonesia-Malaysia-Thailand Growth Triangle
JIS	-Just-In-Sequence
JIT	-Just-In-Time
JPA	-Johor Port Authority
KMO	-Kaiser-Mayer-Olkin
KPA	-Kuantan Port Authority
LKICD	-Lat Krabang Inland Container Depot
LPI	-Logistics Performance Index
MLM	-Maritime Logistics and Management
MOT	-Ministry of Transport
MPA	-Malacca Port Authority
MTL	-Malaysian Thailand Landbridge
NCER	-North Corridor Economic Region
NIP	-Nilai Inland Port
NKVE	-Klang Valley Expressway
NSE	-North-South Expressway
NSECL	-North-South Expressway Central Link
OBOR	-One Belt One Road
PBCT	-Padang Besar Cargo Terminal
PCS	-Port Community System

PIDN	-Port Inland Distribution Network
PKA	-Port Klang Authority
PKN	-Port Klang Net
PPC	-Penang Port Commission
PPP	-Public and Private Partnership
PRQ	-Primary Research Question
PTP	-Port of Tanjung Pelepas
QUAL	-Qualitative
QUAN	-Quantitative
SCORE	-Sarawak Corridor of Renewable Energy
SD	-Standard Deviation
SDC	-Sabah Development Corridor
SEA	-South East Asia
SIP	-Segamat Inland Port
SKRL	-Singapore-Kunming Rail Link
SPDH	-Seremban-Port Dickson Highway
SPSS	-Statistical Package for Social Science
SRQ	-Secondary Research Question
SSS	-Short Sea Shipping
TAR	-Trans-Asia Railways
TEUs	-Twenty Equivalent Units
VAL	-Value Added Logistics
VTC	-Vehicle Transit Centre

LIST OF TABLES

Table 1.1:Growth rate of container throughput in Malaysian container seaports	6
Table 2.1:Variation in dry port definitions from 1982–2012	27
Table 2.2:Differences between dry ports and other inland terminals.....	29
Table 2.3:Characteristics of distance-based dry ports	33
Table 2.4: Characteristics of location-based dry ports	34
Table 2.5: Challenges for dry port development	55
Table 3.1: Influencing factors of dry port operations.....	60
Table 3.2: Focus of seaport competitiveness (1980-2016).....	75
Table 3.3:Seaport competitiveness influenced by dry ports.....	78
Table 4.1: An overview of intra-region freight corridors in Malaysia	100
Table 4.2: Contribution of Asian seaports to world container trade in 2013	118
Table 4.3: General information on Malaysian dry ports	123
Table 4.4: Information on Malaysian expressways connections	126
Table 4.5: Containers freight by rail and road between 2004 and 2013.....	129
Table 4.6: An overview of freight corridors in Malaysian container seaport systems.....	133
Table 5.1: Exploratory sequential design model of the research.....	153
Table 5.2: Sampling frame for qualitative phase.....	157
Table 5.3: Items in the face-to-face questionnaire	158
Table 5.4: Grounded theory vs thematic analysis	162
Table 5.5: Visual model of coding process in qualitative phase	163
Table 5.6: Stratified sampling strategy for quantitative phase	171
Table 5.7: Items in the online questionnaire	173
Table 5.8: Flow of ethics application for the research	180
Table 6.1: Profile of interview participants and interview durations	188
Table 6.2: Reflection process for question A3	191
Table 6.3: Open coding procedure for question A3	192
Table 6.4: Themes development from the coding process for question A3	193
Table 7.1: Response rate for the online-survey	235
Table 7.2: Summary of respondent demography.....	236
Table 7.3: Summary of the Cronbach's Alpha value for 2 constructs	237
Table 7.4: Missing data analysis	238
Table 7.5: Influencing factors of Malaysian dry port operations	241
Table 7.6: Impacts of dry port on seaport competitiveness.....	242
Table 7.7: Estimated TEUs among dry port users 2014-2020	243
Table 7.8: Result of Common Method Bias	245
Table 7.9: KMO and Bartlett's Test (initial run)	247
Table 7.10: Total variance explained for responses in Section B of the survey	249
Table 7.11: Rotated component matrix (showing all values).....	250
Table 7.12: Reliability test for EFA results (Section B)	252
Table 7.13: KMO and Bartlett's Test (initial run)	266
Table 7.14: Total variance explained for responses in Section C of the survey	267
Table 7.15: Rotated component matrix (showing all values).....	268
Table 7.16: Reliability test for EFA result (Section C)	270
Table 7.17: Result of multiple regression on dry ports and seaport competitiveness	281
Table 8.1: Strategies for dry ports development.....	315

LIST OF FIGURES

Figure 1.1: Global containerised throughput 1996-2015 (million TEUs and percentage annual change).....	3
Figure 1.2: Location of Malaysian major container seaports and dry ports.....	7
Figure 1.3: Organisation of this thesis.....	13
Figure 2.1: The seaport evolution towards regionalisation	18
Figure 2.2: A seaport's lifecycle.....	19
Figure 2.3: Components and players in a container seaport system.....	22
Figure 2.4: Dry ports as an extended gate in the container seaport system.....	24
Figure 2.5: Hierarchy of dry ports in inland terminals	31
Figure 2.6: Dry port as having a single or multiple roles in the freight platform.....	38
Figure 3.1: Effects of dry ports on cost of hinterland traffic	82
Figure 4.1: Location of Malaysia	96
Figure 4.2: Location of freight corridors in peninsular Malaysia.....	98
Figure 4.3: Components in the northern freight corridor	102
Figure 4.4: Components in the central freight corridor	104
Figure 4.5: Components in the southern freight corridor	106
Figure 4.6: Components in the east coast freight corridor	108
Figure 4.7: Partners in the South East Asia Growth Triangles.....	109
Figure 4.8: Location of various seaports in Malaysia	113
Figure 4.9: Organisational structure of Malaysian seaports administration.....	114
Figure 4.10: Trend of container throughput in Malaysian seaports 1990–2014	119
Figure 4.11: Rail freight trend 1973–2012	127
Figure 4.12: Malaysian expressway and railway link	128
Figure 4.13: Malaysian container seaport systems.....	136
Figure 5.1: Conceptual framework of the research.....	142
Figure 5.2: The exploratory sequential design	151
Figure 5.3: Data integration in mixed method research	177
Figure 6.1: The procedure of data analysis in grounded theory	189
Figure 6.2: Roles of Malaysian dry ports	194
Figure 6.3: Objectives of Malaysian dry ports	198
Figure 6.4: Functionalities of Malaysian dry ports.....	204
Figure 6.5: Requirements for Malaysian dry port operations.....	212
Figure 6.6: Strength of Malaysia dry ports.....	216
Figure 6.7: Challenges of Malaysian dry ports	220
Figure 6.8: Interviewees' views on influencing factors for dry port operations.....	229
Figure 6.9: Interviewees' views on impact of dry ports on seaport competitiveness.....	231
Table 7.1: Container seaports frequently used by respondents	239
Table 7.2: Important dry ports among the respondents	240
Figure 8.1: Malaysia connection with OBOR network	288
Figure 8.2: Prospects for Malaysian dry port development	291
Figure 8.3: Milk run logistics at ICT	298
Figure 8.4: Transposition of SIP to Gemas dry port	309
Figure 8.5: Barter trade flow in Malaysia.....	313

TABLE OF CONTENTS

DECLARATION OF ORIGINALITY	ii
STATEMENT OF AUTHORITY OF ACCESS	iii
STATEMENT REGARDING PUBLISHED WORK CONTAINED IN THESIS.....	iv
STATEMENT OF CO-AUTHORSHIP	v
STATEMENT OF ETHICAL CONDUCT.....	vii
DEDICATION	viii
ABSTRACT	ix
ACKNOWLEDGEMENTS	xi
LIST OF ABBREVIATIONS	xiii
LIST OF TABLES.....	xv
LIST OF FIGURES.....	xvii
TABLE OF CONTENTS	xiii
 CHAPTER ONE: INTRODUCTION.....	 1
1.1 Research background.....	2
1.1.1 Dry ports in seaport systems.....	4
1.1.2 Dry ports in Malaysia	6
1.2 Research questions and objectives	8
1.3 Research methodology	10
1.4 Structure of this thesis	11
 CHAPTER TWO: DRY PORTS IN A CONTAINER SEAPORT SYSTEM	 14
2.1 Introduction	15
2.2 The emergence of dry ports in the container seaport system	15
2.2.1 The evolution of the role of seaports	15
2.2.2 Seaport development	17
2.2.3 A container seaport system and dry ports.....	21
2.3 Development of dry ports.....	24
2.3.1 Definitions of the term dry port.....	25
2.3.2 Types of dry ports.....	31
2.3.3 Roles of dry ports	35
2.3.3.1 An extended gateway for container seaports.....	35
2.3.3.2 An integrator of intermodal transport systems	36
2.3.3.3 A freight platform.....	37
2.3.3.4 Promoting the regional economy.....	38
2.3.4 Functions of dry ports.....	39
2.4 Challenges of global dry port development and strategies.....	41
2.4.1 Issues in transport infrastructure and operations	41
2.4.1.1 Limited connectivity and accessibility due to insufficient transport infrastructure	42
2.4.1.2 Difficulty for short distance container delivery.....	43
2.4.1.3 Imbalance in modal split.....	44
2.4.1.4 Congestion in dry ports	46
2.4.2 Information sharing	47
2.4.3 Competition	49
2.4.3.1 Competition with seaports	49

2.4.3.2 Competition with inland terminals	51
2.4.4 Location	51
2.4.5 Others	53
2.4.5.1 Expensive labour costs	53
2.4.5.2 Manual procedures in cargo inspection	54
2.4.5.3 Lack of involvement of by the public sector	54
2.5 Summary.....	56

CHAPTER THREE: DRY PORT OPERATIONS AND CONTAINER SEAPORT

COMPETITIVENESS	59
3.1 Introduction	60
3.2 Influencing factors on dry port operations	60
3.2.1 Hinterland conditions	61
3.2.1.1 Location of the dry port	61
3.2.1.2 Transportation connectivity	62
3.2.1.3 The freight market	63
3.2.1.4 The seaport–dry port relationship.....	64
3.2.2 Services features	64
3.2.2.1 Customs clearance	65
3.2.2.2 Container storage, maintenance and transfer.....	65
3.2.2.3 Value-adding services.....	66
3.2.3 Government policy	67
3.2.3.1 Investment policy	67
3.2.3.2 Cabotage policy	67
3.2.3.3 Multimodal transport policy	68
3.2.3.4 Seaport policy	69
3.2.3.5 Transport infrastructure policy	69
3.2.4 Capacity	70
3.2.4.1 Facilities and transport infrastructure	70
3.2.4.2 Space.....	71
3.2.5 Information sharing	72
3.2.5.1 Information collaboration	72
3.2.5.2 Coordination	73
3.3 Dry ports and seaport competitiveness.....	73
3.3.1 Seaport competitiveness	74
3.3.2 The impact of dry ports on seaport competitiveness	77
3.3.2.1 Enhancement in seaport performance.....	78
3.3.2.1.1 Ship calling frequency	79
3.3.2.1.2 Reliability	79
3.3.2.1.3 Efficiency.....	80
3.3.2.1.4 Costs	81
3.3.2.1.5 Berth productivity.....	82
3.3.2.2 Enhancement in seaport capacity	82
3.3.2.2.1 Additional space for seaports	83
3.3.2.2.2 Additional facilities to seaports	83
3.3.2.3 Improvement in seaport-hinterland proximity	84
3.3.2.3.1 Hinterland transport networks	85
3.3.2.3.2 Hinterland extension.....	85

3.3.2.3.3 Hinterland accessibility	86
3.3.2.3.4 Hinterland connectivity	87
3.3.2.4 Increase in service variations for seaports	87
3.3.2.4.1 Supplementary services for seaports	88
3.3.2.4.2 Flexibility	89
3.3.2.5 Increase in seaport trade volume	90
3.3.2.5.1 Continuity in container flow	90
3.3.2.5.2 Transshipment containers	91
3.5 Summary	92

CHAPTER FOUR: MALAYSIAN CONTAINER SEAPORT SYSTEMS 94

4.1 Introduction	95
4.2 Geographic features	95
4.3 Freight corridors in container seaport systems	97
4.3.1 Intra-regional freight corridors	97
4.3.2 Inter-regional freight corridors	108
4.4 Container seaports	112
4.5 Dry ports	119
4.6 Multimodal transportation	124
4.6.1 Road networks	124
4.6.2 Rail networks	126
4.7 Mapping the Malaysian container seaport system	131
4.8 Summary	136

CHAPTER FIVE: RESEARCH METHODOLOGY 139

5.1 Introduction	140
5.2 The conceptual framework of the research	141
5.3 Research philosophy and approach	142
5.4 Research design	145
5.4.1 Mixed methods	145
5.4.2 Research questions	146
5.4.3 Research unit of analysis	149
5.4.4 Mixed methods design	149
5.5 Qualitative data collection and analysis	153
5.5.1 Sampling strategy	154
5.5.2 Questionnaire design and pretesting	157
5.5.3 Administration for data collection	158
5.5.4 Data analysis	160
5.5.5 Validity and reliability	163
5.6 Quantitative data collection and analysis	166
5.6.1 Sampling strategy	166
5.6.2 Questionnaire design and pretesting	172
5.6.3 Administration for data collection	174
5.6.4 Data analysis	176
5.6.5 Validity and reliability	177
5.7 Research ethics	179
5.8 Procedures for bias management	180
5.8.1 Procedures for error control	181

5.9 Summary.....	183
------------------	-----

CHAPTER SIX: QUALITATIVE DATA ANALYSIS AND DISCUSSION 185

6.1 Introduction	186
6.2 Profile of respondents.....	186
6.3 Procedure of data analysis	187
6.4 Results and discussion.....	193
6.4.1 Roles of Malaysian dry ports in the seaport system	194
6.4.1.1 An extended seaport	195
6.4.1.2 Regional intermodal nodes	196
6.4.1.3. An interface terminal.....	196
6.4.2 Objectives of dry ports	198
6.4.2.1 Accelerating national and international trade.....	199
6.4.2.2 Activating intermodalism in the nation	200
6.4.2.3 Improving seaport competitiveness	200
6.4.2.4 Enhancing regional economic development.....	201
6.4.2.5 Establishing Malaysian seaport policy	203
6.4.3 The functionalities of Malaysian dry ports.....	203
6.4.3.1 The transport function	204
6.4.3.2 The administration function.....	204
6.4.3.3 The logistics function	206
6.4.3.4 Value adding function	206
6.4.4 Users of Malaysian dry ports.....	208
6.4.5 Benefits of Malaysian dry ports	208
6.4.5.1 Reducing waiting times at seaports	209
6.4.5.2 Providing clearance systems.....	209
6.4.5.3 Reducing freight costs	210
6.4.5.4 Facilitating cross border transactions	210
6.4.5.5 Reducing empty container movements.....	211
6.4.6 Requirements for Malaysian dry port operations	212
6.4.6.1 Operational infrastructure.....	212
6.4.6.2 Personnel requirements	213
6.4.6.3 Capital infrastructure	215
6.4.7 The strength of Malaysian dry ports.....	215
6.4.7.1 Strategic location	216
6.4.7.2 The involvement of public and private sectors.....	218
6.4.7.3 Transport connectivity	219
6.4.8 Challenges in Malaysian dry ports	220
6.4.8.1 Transport infrastructure and operation	220
6.4.8.2 Container planning	222
6.4.8.3 Competition	224
6.4.8.4 Location	226
6.4.8.5 Community	226
6.4.9 Influencing factors for dry port operations.....	228
6.4.10 The impact of dry ports on seaport competitiveness	229
6.5 Development of the online survey instrument.....	230
6.6 Summary.....	232

CHAPTER SEVEN: QUANTITATIVE DATA ANALYSIS AND DISCUSSION	233
7.1 Introduction	234
7.2 Online survey response rate.....	234
7.3 Demography of respondents	235
7.4 Descriptive statistics	236
7.4.1 Reliability of the constructs	237
7.4.2 Missing data analysis.....	237
7.4.3 Container seaports used by respondents	238
7.4.4 Dry ports used by respondents.....	239
7.4.5 Influencing factors of dry port operations	240
7.4.6 The impact of dry port operations on seaport competitiveness	241
7.4.7 Expected throughput.....	242
7.4.8 The importance of transportation modes for container transportation	243
7.5 Exploratory factor analysis on Malaysian dry ports	243
7.5.1 Suitability of data for EFA	244
7.5.2 The factor extraction method.....	245
7.5.3 Criteria for extraction and the rotation method	246
7.5.4 Interpretation and labelling	247
7.6 Influencing factors of dry port operations	247
7.6.1 The validity and reliability of EFA results	251
7.6.2 Discussion of results	251
7.6.2.1 Capacity	252
7.6.2.2 Information sharing	255
7.6.2.3 Service features.....	258
7.6.2.4 Government policy	260
7.6.2.5 Hinterland conditions	261
7.6.2.6. Location	263
7.6.2.7 Administration	264
7.7 The impact of dry ports on seaport competitiveness	266
7.7.1 Validity and reliability of EFA results	268
7.7.2 Discussion of results	269
7.7.2.1 Enhancement in seaport performance.....	269
7.7.2.2 Increase in service variations for seaports	273
7.7.2.3 Improvement in seaport-hinterland proximity.....	275
7.7.2.4 Increase in seaport trade volume	277
7.7.2.5 Enhancement in seaport capacity	279
7.8 Dry port influencing factors and seaport competitiveness	280
7.9 Summary.....	282
 CHAPTER EIGHT: STRATEGIES FOR MALAYSIAN DRY PORT DEVELOPMENT	 284
8.1 Introduction	285
8.2 Opportunities of Malaysian dry ports for future development	286
8.2.1 Accessibility to international transport networks	286
8.2.2 Government's international and national economic development plans.....	288
8.3 Strategies and recommendations for Malaysian dry ports' development.....	292
8.3.1 Transport infrastructure and operation strategy.....	293
8.3.1.1 Introduction of double track rails	293

8.3.1.2 Providing options for east coast Malaysian freight transportation	294
8.3.1.3 Increasing modal split by increasing rail transport.....	295
8.3.1.4 Providing haulier services through vertical integration.....	296
8.3.1.5 Milk-run logistics	297
8.3.1.6 Utilisation of intra & inter regional economic development.....	298
8.3.2 Container Planning	299
8.3.2.1 Information sharing for planning container distribution	299
8.3.2.2 Location pooling between dry ports and inland terminals	301
8.3.3 Competition	302
8.3.3.1 Enhancing the capability of dry ports.....	302
8.3.3.2 Cooperation between seaports and dry ports	304
8.3.4 Location	305
8.3.4.1 Increase SIP's attractiveness by enhancing multimodal transportation and providing different services.....	306
8.3.4.2 Collaboration with other dry ports	307
8.3.4.3 Location shifting.....	307
8.3.5 Community.....	309
8.3.5.1 Freight transportation development.....	310
8.3.5.2 Dry port marketing	310
8.3.5.3 Safety and security.....	311
8.3.5.4 Involvement of dry ports in the barter trade	312
8.4 Summary.....	315
CHAPTER NINE: CONCLUSION	317
9.1 Introduction	318
9.2 Findings from the literature review	318
9.3 Summary of the empirical findings	320
9.4 Contributions of the research.....	324
9.5 Limitations of the research	327
9.6 Directions for future research	328
REFERENCES	331
APPENDICES.....	365

CHAPTER ONE

INTRODUCTION

1.1 Research background

Trade policy liberalisation and technological advancement have contributed to a robust development in international trade (Bernhofen et al. 2016). Since the 1960s, containerisation has improved the performance of international trade at a rapid pace. Global containerised trade has increased from 50 million TEUs in 1996 to 171 million twenty equivalent unit (TEUs) in 2014 (UNCTAD 2015). Figure 1.1 indicates the trend of world container growth from 1996 to 2015.

About 50 million TEUs were recorded in 1996 with a consistent increment in growth until 2008 where it became 139 million TEUs. After a decrease due to the economic crisis from 2008 to the end of 2009, container traffic started increasing again up to 160 million TEUs in 2013. It was forecast that 180 million TEUs would be recorded in 2015 (UNCTAD 2015). The average annual trade growth rate for the past 30 years has been around four percent (UNCTAD 2015). Moreover, UNESCAP (2006) has foreseen that annual growth rates of containers will probably rise even higher until the year 2022, and that there will be a substantial increase in the volume of international shipping.

The rapid growth of seaborne trade has left a great impact on, and also exerted a great deal of pressure on the capacity of transport infrastructure, especially on roads, railways and seaports.

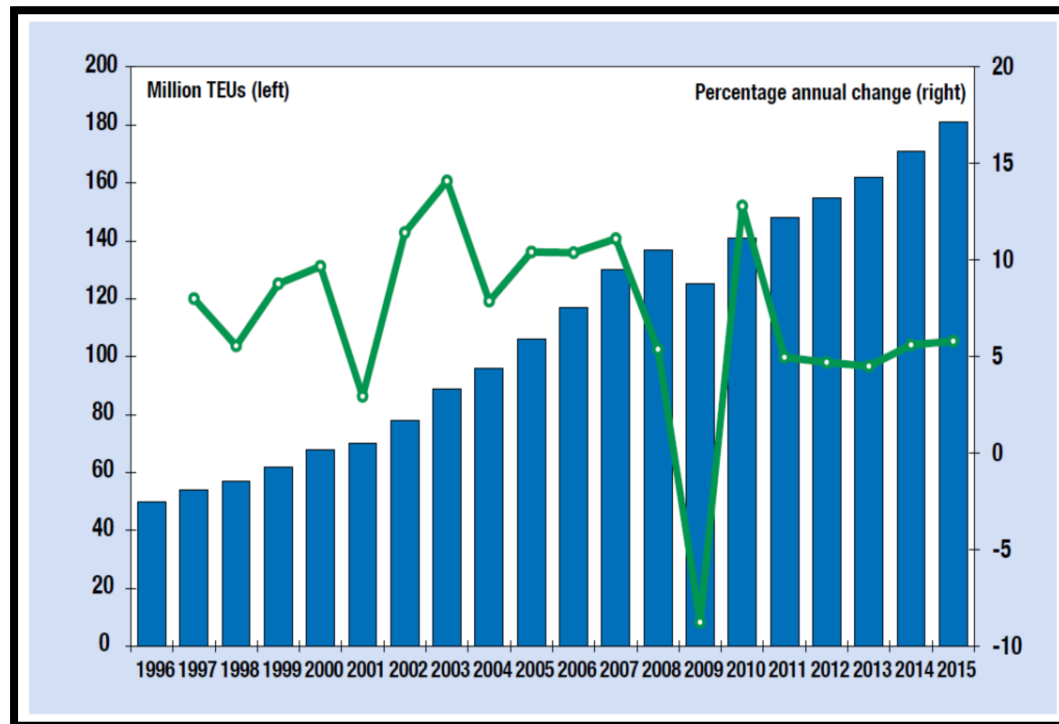


Figure 1.1: Global containerised throughput 1996-2015 (million TEUs and percentage annual change)

Source: Adapted from UNCTAD (2015)

For example, in Asia the share of global trade volume increased from 59% in 2002 to 70.5 % in 2013 and it was forecast to continue increasing dramatically until 2019 (UNCTAD 2013; Salisbury 2014). In particular, massive increments in container trade have forced seaports to increase their capability to manage containers. However, some seaports have had to deal with restrictions in physical development by measures such as reclamation, due not only to space limitations but also to environment issues. They have also started to choose to outsource logistic centres to improve their capacity, in order to ease the flow of containers at them, to provide efficient services, and also to benefit their customers either from inland or from foreland.

Logistic integration and a seaport regionalisation phase in the development of seaports has brought the perspective of seaport development far beyond its immediate perimeter further into its hinterland (Notteboom & Rodrigue 2009). That integration, along with an inland

component to the seaport system has become an important factor in shaping the performance and competitive strategies of seaports. This has been evident in the development of inland logistic centres such as dry ports, inland ports, distribution terminals, freight villages, inland freight terminals, and inland container depots. According to Rimiene and Grundey (2007), a logistic centre is a village planned and built to best manage all the activities involved in freight movement. Rimiene and Grundey (2007) further stated that logistic centres like this are also a promoter of local consolidation, intermodal transportation, and regional economic activities.

1.1.1 Dry ports in seaport systems

A dry port is ‘an inland intermodal terminal directly connected to seaports with high capacity transport means, where customers can leave and pick up their standardised units as if directly to a seaport’ (Roso et al. 2009, p.4). Therefore, a dry port provides services for the handling and temporary storage of containers and for general and/or bulk cargo that enters or leaves the dry port by any mode of transport such as road, railways, inland waterways or airports. Full customs-related services and other related services such as essential inspections for cargo export and import, whenever possible, should be put in place in a dry port to ease the freight movement from seaport to inland and vice versa (Beresford & Dubey 1990; UNCTAD 1991).

Dry ports are logistic centres which help simplify the movement of containers without customs inspections, either during inbound or outbound journeys through seaports. Dry ports provide vital advantages for seaports in avoiding heavy truck traffic or relieving congestion at the seaport gateway (Slack 1999). They also play the role as a focal point in supply chains connecting various locations in the seaport system (Notteboom & Rodrigue 2005). This can help reduce the waiting of fleets in their berths or terminals, providing a

huge relief to the seaport as well as to clients. As an inland logistic centre, dry ports play an increasingly important role in the multimodal transport network that supports the economic activities of local enterprise by facilitating their exports and imports of raw materials, semi-manufactured products and finished goods, and distributing them straight to customers (Notteboom 2007).

The development of dry port networks demonstrates a competency to streamline the transportation process. Provisions for customs clearance and cargo inspections help shippers and manufacturers to gain immediate access to the international market (UNESCAP 2010). Notteboom (2005) indicated that seaports are the central nodes driving the dynamics in a large logistic pole, but at the same time they rely heavily on dry ports for preserving attractiveness. Stakeholders believe that dry ports play an important part in ensuring the efficient transit of goods from a factory in their country to retail distribution points in the country of destination (Beresford et al., 2012).

The complexity of the environment in which seaports exist can generate challenges for them in offering competitive services to customers. This complexity includes growing vessel sizes, demands for logistic services at seaports, and the involvement of a great diversity in industry and in the community of players (Notteboom & Winkelmanns 2001). Talley (2011) argued that logistic centres function as an interface for the entire seaport community and are necessary for increasing seaport competitiveness. As Leveque and Roso (2002) recommended, dry ports serve as an extended hinterland for seaports and are able to help fulfil customer needs. Therefore, a dry port performing as an interface between seaports and their various stakeholders is an effective strategy for enhancing container seaport competitiveness.

1.1.2 Dry ports in Malaysia

In Malaysia, four main dry ports have been developed since 1984 to support seaport operations, in particular container terminals. The increase of container traffic in Malaysian seaports over the years has further generated demands for dry ports as important logistic nodes for facilitating seaport operations (Nazery et al. 2012). As shown in Table 1.1, growth rates of container throughput between 2008 and 2014 in three main Malaysian container seaports, Port Klang, Penang Port and PTP, were 37.9%, 30.4% and 49% respectively. In terms of volume, Port Klang recorded 7.9 million TEUs and 10.9 million TEUs in 2014. For PTP, it recorded 5.5 million TEUs in 2008 and 8.2 million TEUs in 2014. Penang Port recorded 0.92 million TEUs in 2008 and 1.2 million TEUs in 2014. The constant growth of container throughput in these seaports clearly shows the importance of dry ports for container distribution and transportation from seaports to the hinterland and vice versa.

Table 1.1: Growth rate of container throughput in Malaysian container seaports

Ports /Year (million TEUs)	2008	2009	2010	2011	2012	2013	2014	Growth rate in 7 years
Port Klang	7.9	8.4	8.7	9.4	9.9	10.3	10.9	37.9%
PTP	5.5	5.6	5.7	7.3	7.4	7.4	8.2	49.0%
Penang Port	0.92	0.94	0.95	1.2	1.1	1.2	1.2	30.4%

Source: Adapted from MOT (2015)

Padang Besar Cargo Terminal (PBCT) was the first dry port developed in 1984 to handle containers to and from Southern Thailand by trains and road haulages, and which are then shipped through Penang Port and Port Klang (UNESCAP 2006). The second dry port Ipoh Cargo Terminal (ICT) is located at a strategic inland location in relation to Port Klang and Penang Port (see Figure 1.2). ICT helps to provide Northern region based traders with an alternative choice of seaports for their businesses, instead of having direct association with

Port Klang and Penang Port. ICT is a well-known dry port for import and export of most major and small scale industries within Northern Malaysia.

Nilai Inland Port (NIP) is located at the centre of peninsular Malaysia between Port Klang and the Port of Tanjung Pelepas (PTP), a well-known dry port hub to both major container terminals. NIP offers services, and space to facilitate growing container volumes at Port Klang in the central region and PTP in the south. Segamat Inland Port (SIP) offers facilities and services to manufacturers and traders in the southern region of peninsular Malaysia. It was developed to assist PTP and Port Klang in becoming preferred seaports of choice, and it was developed as a national load centre and transshipment hub (UNESCAP 2006; MOT 2012).

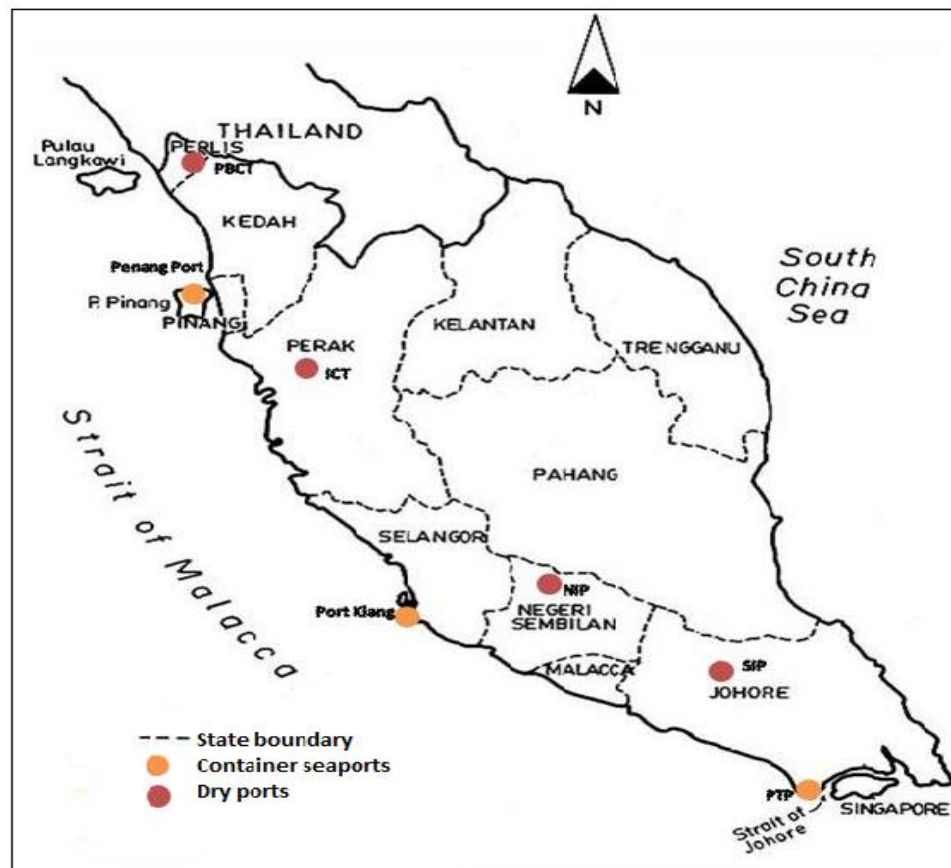


Figure 1.2: Location of Malaysian major container seaports and dry ports
Source: Adapted from MOT (2015)

Malaysian dry ports help extend container seaport services and their facilities inland to reduce seaport congestion and the unnecessary delays that can occur at the seaport. Each dry port has assisted container terminals in managing container distribution within Malaysia, as well as for international transshipment containers heading to and from South Asia, Cambodia, Thailand and Vietnam. Malaysian Railway provides rail freight infrastructure and it operates daily services to some dry ports in order to support freight movement to and from seaport container terminals (Malaysian Railway 2012).

To support and accommodate the growth of container traffic, container seaports need to improve their capacity, functions and services to facilitate supply chain networks, support and accommodate trade growth and finally direct further development of the existing network (Rodrigues 2008). Dry ports have increasingly played a visible and active role in facilitating national trade and in enabling goods to be transported and distributed from seaports to the final destination. Tsilingris and Laguardia (2007) stated that efficient and sophisticated value adding services are one of the essential and determining factors of dry port performance.

1.2 Research questions and objectives

Dry ports are an integral part of logistic centres and an element of the local, national and international transportation systems (Rodrigue et al. 2010). However, as addressed by Nazery et al. (2012), most dry ports in Malaysia have insufficient infrastructure and facilities, which has limited their ability to support adjacent seaports. Additionally, the services provided by Malaysian dry ports are not sufficient to fulfil customer needs (Nazery et al. 2012; MOT 2012). Consequently, some dry ports such as SIP have been underutilised with a low recorded volume of containers handled (Nasir 2014). Distance, accessibility to and from seaports, access to the road and rail system, linkage between and

within modes and limited railway tracks are problems of Malaysian dry port operations (Nazery et al. 2012). This requires further research on how to improve dry port operations in that nation.

For the last decade, the importance of interdependence between dry ports and container seaports has attracted worldwide academic research on dry port development. This research includes Roso (2008); Roso et al. (2009), Roso & Lumsden (2010); Panayides & Song (2009); Ng & Gujar (2009); Bergqvist et al. (2010); UNESCAP (2010); Haralambides & Gujar (2012); Cullinane et al. (2012); Ng et al. (2013) and Andersson & Roso (2016). Nevertheless, there has been very limited research undertaken on the Malaysian context. This research thus aims to investigate how dry port development in Malaysia has enhanced the competitiveness of the container seaport system. It explores the roles, functions, objectives, benefits, challenges and opportunities of Malaysian dry ports in the container seaport system, and examines the influencing factors of dry port operations and how their operations impact on container seaport competitiveness.

Based on the research background, the primary research question (PRQ) of this research is as follows:

PRQ: How can dry port development in Malaysia enhance the competitiveness of container seaports in the container seaport system?

Three secondary research questions (SRQ) are generated to answer the primary research question.

SRQ 1: What are the roles and challenges of existing Malaysian dry ports in the container seaport system?

SRQ 2: *What are the influencing factors of Malaysian dry port operations and their impacts on the competitiveness of Malaysian container seaports?*

SRQ 3: *What are the strategies for enhancing Malaysian dry port operations and further development?*

Based on the research questions, this research will achieve the following objectives.

- Review current management and operations of Malaysian container seaport systems, including container seaports, dry ports, multimodal transportation and container freight corridors;
- Identify the factors influencing Malaysian dry port operations relevant to container seaport competitiveness;
- Examine the challenges and opportunities encountered by Malaysian dry ports; and
- Recommend strategies for improving dry port operations and management in Malaysia.

1.3 Research methodology

This research employed an exploratory sequential mixed method with qualitative and quantitative phases to collect empirical data in order to answer the research questions and achieve the objectives. Interviews were undertaken in the qualitative phase, followed by an online survey in quantitative phase. After undertaking a comprehensive literature review on dry port studies, 11 face-to-face interviews with government bodies, rail operator, seaports and dry port operators were conducted to explore the role and challenges of Malaysian dry ports in the container seaport system. Data collected from this phase were analysed using grounded theory to identify the objectives, functionalities, users, benefits, operational requirements, strengths and challenges of Malaysian dry ports. Outcomes from the qualitative phase were used to develop an online survey instrument for the quantitative

phase of this research. At this phase, data were analysed by employing exploratory factor analysis (EFA) to identify the influencing factors of Malaysian dry port operations and their impacts on container seaport competitiveness. Hauliers, freight forwarders, shippers, shipping lines, seaport operators and the rail operator were the main participants. Integration of qualitative and quantitative results into a single body of research develops a methodologically comprehensive study of dry ports and container seaports and demonstrates a way of mixing different types of data into a single piece of research.

1.4 Structure of this thesis

This thesis consists of nine chapters, outlined as follows:

Chapter One is the introduction to the thesis. It begins with the research background and presents research questions and research objectives, a brief introduction to the research methodology and structure of the thesis.

Chapter Two reviews the evolution of seaport development and the emergence of dry ports in the container seaport system. In addition, this chapter discusses the definition, roles and functionalities of dry ports based on the extant literature. It also synthesises the challenges dry ports face in terms of worldwide experiences in dry port development.

Chapter Three reviews the literature to identify factors influencing dry port operations and the impact of dry port operations on seaport competitiveness. Chapter Four introduces the background of this research that is the Malaysian container seaport system. Components of the system include seaports, dry ports, container freight corridors and multimodal transportation and are addressed. It provides an overview of current management, operations and the development of each component in the container seaport system.

Connectivity within the container seaport system, in the particular seaport-dry-port-hinterland is also evaluated in this chapter.

Chapter Five focuses on the research methodology of this research. The conceptual framework of this research is developed based on the literature review in Chapter Two, Chapter Three and Chapter Four for further empirical study. It explains the research design and it identifies the unit of analysis, methods for data collection and the data analytical method. This research adopts a mixed method methodology for primary data collection, and it combines face-to-face interviews and online questionnaire surveys.

Chapter Six presents the findings with a discussion from the qualitative phase of data collection. It reports the role, objectives, functionality, benefits, requirements, strength and challenges to Malaysian dry ports in the container seaport system. Moreover, this chapter addresses how the survey instrument was developed for the quantitative phase based on the outcomes from the qualitative phase.

Chapter Seven presents the analytical results of the quantitative data collected from questionnaire surveys employing exploratory factor analysis. The analysis reveals significant factors influencing Malaysian dry port operations as well as the significant impacts that those factors have on container seaport competitiveness. This chapter finally employs a multiple regression analysis to identify the areas of container seaport competitiveness which are significantly impacted on by the influencing factors of Malaysian dry ports.

Chapter Eight recommends strategies for Malaysian dry ports to overcome existing problems and to utilise existing opportunities for future development. The findings from both phases of the research are used for the discussion.

Chapter Nine concludes the research, including a summary of the findings, research contributions, research limitations and recommendations for future research. The flow of the dissertation is portrayed in Figure 1.3.

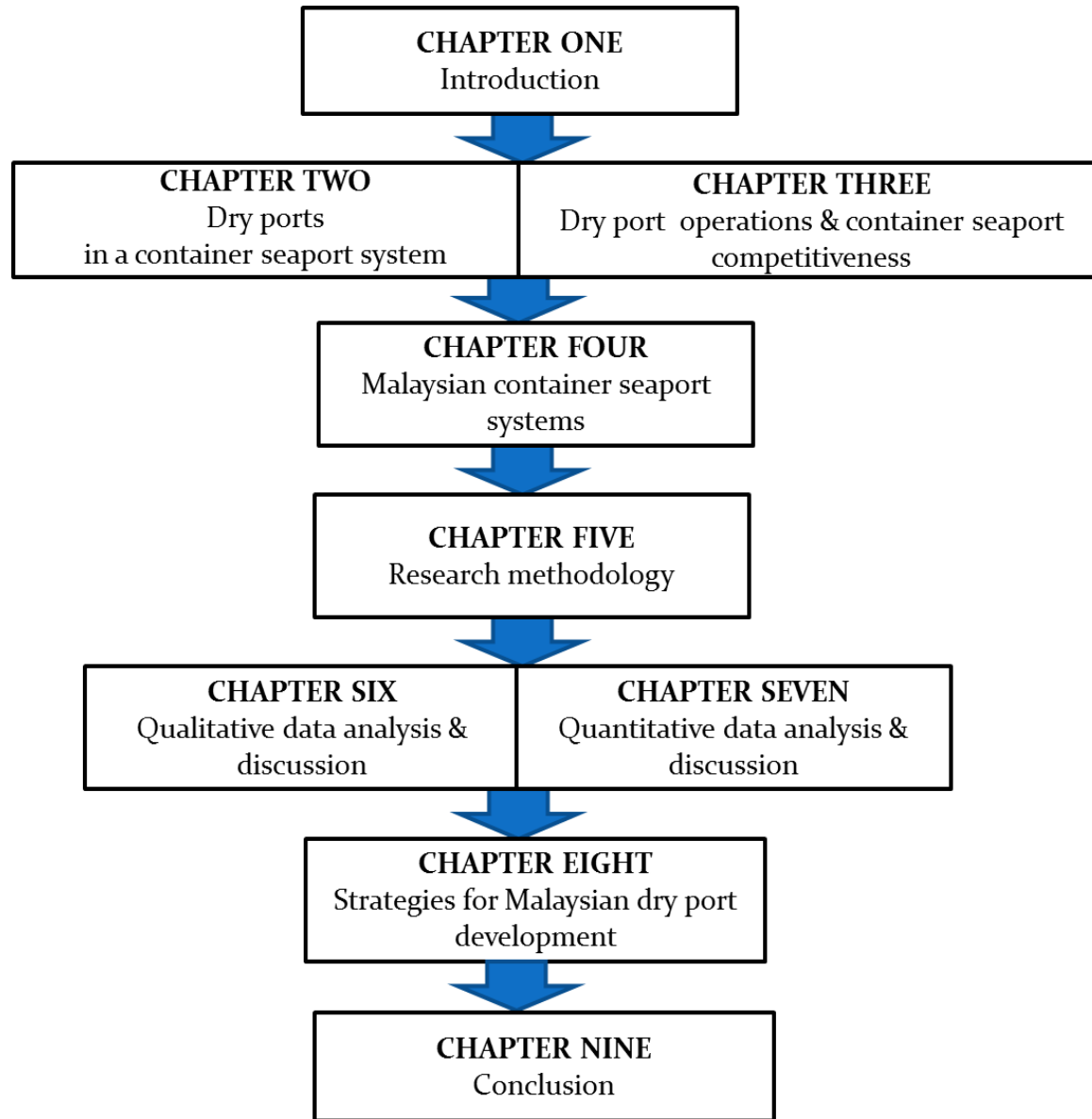


Figure 1.3: Organisation of this thesis

CHAPTER TWO

DRY PORTS IN A SEAPORT SYSTEM

2.1 Introduction

This chapter begins with a discussion on how dry ports have emerged in the container seaport system in terms of the evolution of the role and development of seaports themselves. Subsequently, the role and functionality of dry ports are discussed to elucidate why dry ports are suitable and stable intermodal terminals which can assist seaports in the container transportation chain. Finally, based on worldwide experiences, some challenges of dry port development and operations are outlined and discussed.

2.2 The emergence of dry ports in the container seaport system

This section discusses the emergence of dry ports in terms of the evolution of their role and development in context of concepts used to understand seaports. It also explains a container seaport system in which dry ports are included.

2.2.1 The evolution of the role of seaports

A seaport is a gateway through which goods and passengers are transferred between ships and the shore (Gross 1990). It is a place providing facilities for berthing and handling cargo (Robinson 2002), and the four-modal nodes where ocean ships, short-sea, road and rail modes converge and develop a complementary relationship between waterborne and land modes (Charlier 1992). Therefore, seaports traditionally are a gateway and a maritime intermodal interface in the transport chain, with their main role being a trade and transport logistic facilitator with the provision of services to ships and their cargo both seaside and landside.

The role of seaports has changed due to a globalised and deregulated environment (Robinson 2002). Technological changes such as containerisation and the development of intermodal logistic, which emphasise door-to-door services, have made seaports a node in

the supply chain network. As a result, seaports have become a network-based entity (Hall 2002). The network concept has pushed seaports to develop their relationship with their hinterlands and regions.

As a key element in the supply chain, seaports provide logistic functions such as cargo management, information sharing, logistic integration and value adding services. To ensure that cargo is transported smoothly and quickly to the next stage of the logistic system, seaports have to be able to facilitate inter-modality and be involved in providing various value adding services. These include warehousing, storage, packing and, importantly, making preparations for the containers so that they are ready to be delivered to the destination via inland transportation (Heaver et al. 2000; Lu 2000; Martino 2003; Notteboom 2007; Wong et al. 2016).

Seaports play an integral part in maritime logistic and in the increase of the development of distribution centres and infrastructure for inland connections (World Bank 2006; Lee & Lam 2016). This is the concept of seaport-centric logistic, emphasising the role of seaports as the logistic hub of supply chains (Mangan et al. 2008). However, there may be constraints, such as capacity, for seaports to provide all logistic activities mentioned above (Notteboom 2000). Significant issues will be created such as congestion which affects the vessel turnaround time at the seaport if they execute their role with limited capacity in maritime logistic (Panayides & Song 2009). Therefore, it becomes important for seaports to develop inland strategies. For example, seaports cooperate with inland terminals such as dry ports where selective seaport activities are performed (Klink 2000; Lee & Lam 2016). This complies with the tendency of seaports to seek assistance from intermodal terminals to adjust with trade changes.

2.2.2 Seaport development

Seaport development is referred to as an intense interaction between technology development, organisations and territory, and it is a discontinuous, cumulative process, which develops and appears as a series of innovations (Storper 1997; Lee & Flynn 2011). In other words, seaport development is a systematic approach through an interaction of economics, physical structures, political institutions and social environment (Sanchez & Tuchel 2005; Petit & Beresford 2009).

The evolution of seaport development can be explained by several theoretical concepts such as Bird's (1963) Anyport Model, revised by Rimmer (1967) and Hoyle (1968), and seaport regionalisation (Notteboom & Rodrigue 2005). Based on seaport development concepts, factors driving seaport development over the years include economic, technological and political factors (Taaffe 1963; Bird 1984), seaport competition from developing adjacent seaports (Hayuth 1981; 1988) and the logistic integration between foreland and hinterland (Robinson 2002; Rodrigue & Notteboom 2009).

The Anyport Model indicate three major stages of seaport development as shown in Figure 2.1 (Bird 1963). At the setting stage, a seaport depends mostly on geographical factors. It is a key element of urban centrality, and is classified as operating in isolation and performing as an interface between hinterland and foreland (Notteboom 2000). During seaport expansion, the hinterland connection starts to develop in order to ease the proportional growth in maritime traffic. The integration of rail links with the seaport terminals are required to enable the seaport to access the inland area (Bird 1963). During seaport specialisation, numerous opportunities are created for other users to utilise the seaport's facilities such as housing and commercial development (Bird 1963). The

outcomes from global containerisation and intermodalism result in seaports becoming dynamic leading nodes in distribution networks.

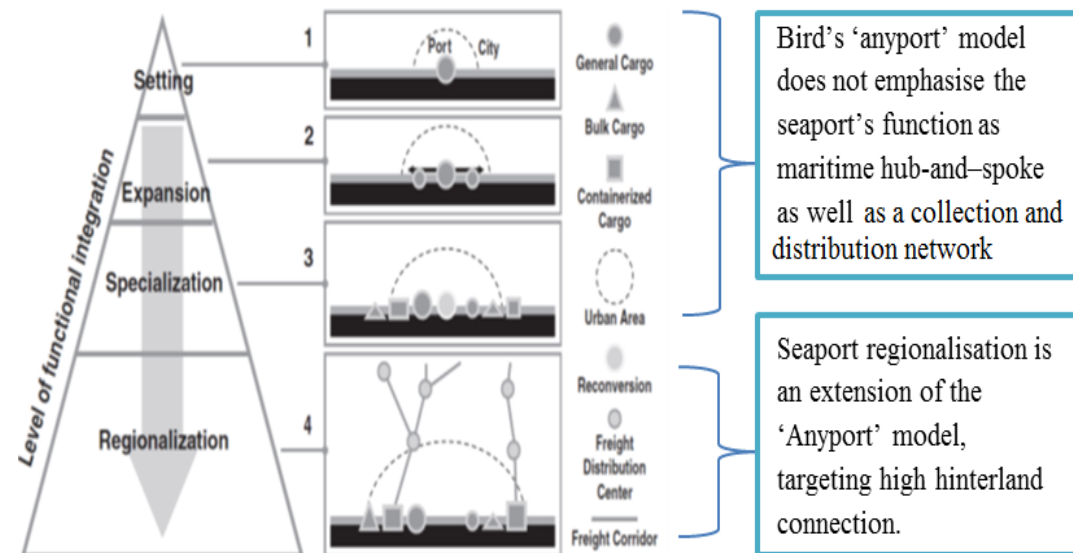


Figure 2.1: The seaport evolution towards regionalisation
Source: Adapted from Notteboom and Rodrigue (2005)

Notteboom and Rodrigue (2005) added an additional stage “regionalisation” into the Anyport Model, and it has attracted the role of inland terminals in seaport development (Monios & Wilmsmeier 2011). Seaport regionalisation is the development of a seaport incorporating the support of a freight distribution centre, and it ultimately leads to the formation of a regional load centre network. The performance of the regional load centre depends on the efficiency of cargo linkages between nodes (Hayuth 1988; Notteboom & Rodrigue 2005). The development of a dry port as a regional load centre improves the efficiency of cargo linkages from seaports until the final destination (Visser 2006; Monios & Wilmsmeier, 2014) and operates as a medium to execute seaport regionalisation.

A regionalisation strategy possessed high potential to reduce the inland distribution costs of containers by 18%, comprising 40% to 80% of the total inland costs of container shipping (Notteboom 2004; Monios & Wilmsmeier 2012). Seaport regionalisation

represents a different dimension in seaport development whereby the efficiency of a seaport system is determined by the integration of the inland freight distribution system. Since a seaport represented a physical and functional link between the logistic and transportation networks, it needs to meet certain requirements in intermodal and landside links such as to access infrastructure and connectivity with the economic system of the hinterland (Sanchez & Tichel 2005). The existence of a dry port provided infrastructure and connectivity from seaports to hinterlands. It also improved the physical and functional link between transportation networks and reduced the pressure on seaports. Therefore, dry ports can promote seaport regionalisation.

In addition to seaport regionalisation, the seaport lifecycle concept by Sanchez and Wilmsmeier (2010) implied the importance of inland terminals in seaport development. A seaport requires a structural transformation to maintain its competitiveness. The structural transformation of a seaport is the ability to change the seaport's layout, the services it offers and the logistical network beyond the seaport. From a macro-economic perspective, a seaport's lifecycle relevant to seaport development is divided into development, introduction, growth, maturity and decline stages (Sanchez & Wilmsmeier 2010) as shown in Figure 2.2.

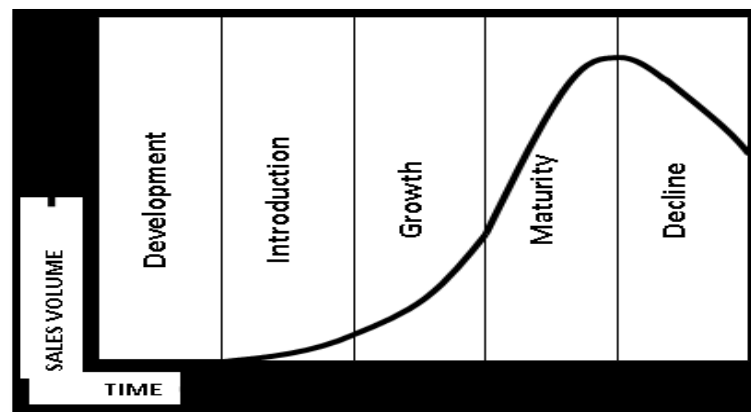


Figure: 2.2: A seaport's lifecycle
Source: Sanchez and Wilmsmeier (2010)

Development, introduction and growth stages are generally related to services provided by the seaport to other regions. The geographic reach into the seaport hinterland is totally restricted to the neighbouring city. Therefore, the development of the hinterland infrastructure is the main concern during these three stages (Sanchez & Wilmsmeier 2010).

At the stage of maturity, seaport activities become slower, containerisation is fully implemented and competition in the market increases. Dry ports may help to overcome the physical constraints of seaports and cater for the high volume of containers for further expansion. The assistance of dry ports which provide additional space for seaports tends to prolong the maturity stage of seaports and increases the life cycle of seaports (Cullinane et al. 2012).

The seaport lifecycle elaborates on the operational scale and scope of freight distribution which has become stretched, and facilitates the extension of freight distributions to a global scale (Rodrigue 2006). Accessibility to the hinterland and a high geographic scope of freight distribution through inland terminals became an important aspect for a seaport to engage with broader international trade (Sanchez & Wilmsmeier 2010; Cullinane & Wilmsmeier 2011).

In a nutshell, seaport development is a process of creation and adaptation to satisfy changing demands of clients with shifting requirements from basic seaport facilities to logistical facilities on a geographic scale, from local to an intercontinental presence. It is difficult for a seaport to react to logistical or operational changes in its network due to time, cost and space limitations (Paixao & Marlow 2003). Dry ports as flexible and agile terminals assisted seaports to adapt with the changes and develop into a core component for seaport development.

2.2.3 A container seaport system and dry ports

Prior to containerisation, a seaport system is focused on competition between different ports and terminal operators as well as interaction between hinterlands and forelands (Weigend 1956; Thomas 1957; Ng and Tongzon, 2010). As discussed in the previous section, the technological improvements in multimodal transportation and transportation infrastructure change the borders of the connectivity between seaports and its hinterland network through inland facilities (Notteboom and Rodrigue 2005). The function of container seaports as intermodal hubs enables containers to be shipped long distances across the continent to fulfil market demand (Song 2003). Confronted with these changes, container seaports adjust their infrastructure for hinterland connection, create efficient cargo information systems, and value add services as these are essential inputs required for becoming familiar with the changes in the container seaport system (Notteboom & Rodrigue 2005). In this context, a container seaport system is thus extended to seaport hinterlands through the development of inland transportation facilities connecting the relevant stakeholders in the seaport community (Li et al. 2012).

Container seaports, inland freight facilities, multimodal transportation, and freight corridors are the main components in the container seaport system (Rodrigue 2004; Bichou and Gray 2004; Notteboom and Rodrigue 2005; Jugovic et al. 2011). It also involves many players such as port authorities, container shipping lines, freight forwarders, seaport and inland terminal operators, and intermodal transport operators. Container shipping lines offer shippers door-to-door services and integrated logistic services by coordinating with feeder operators, road carriers, rail operators, logistic service providers and terminal operators (Lun 2009).

Figure 2.3 shows the components and players consisting in a container seaport system. These are the key determinates for seaport regionalisation which emphasise the integration of seaports and their hinterland (Notteboom & Rodrigue 2005). In container seaport systems, logistic systems facilitate the flow of goods by seeking linkages that will enable the product to flow faster at the lowest cost (Christopher 2005). For freight facilitation, the support from a freight corridor and intermodal terminals is required for effective freight distribution (Rodrigue 2004).

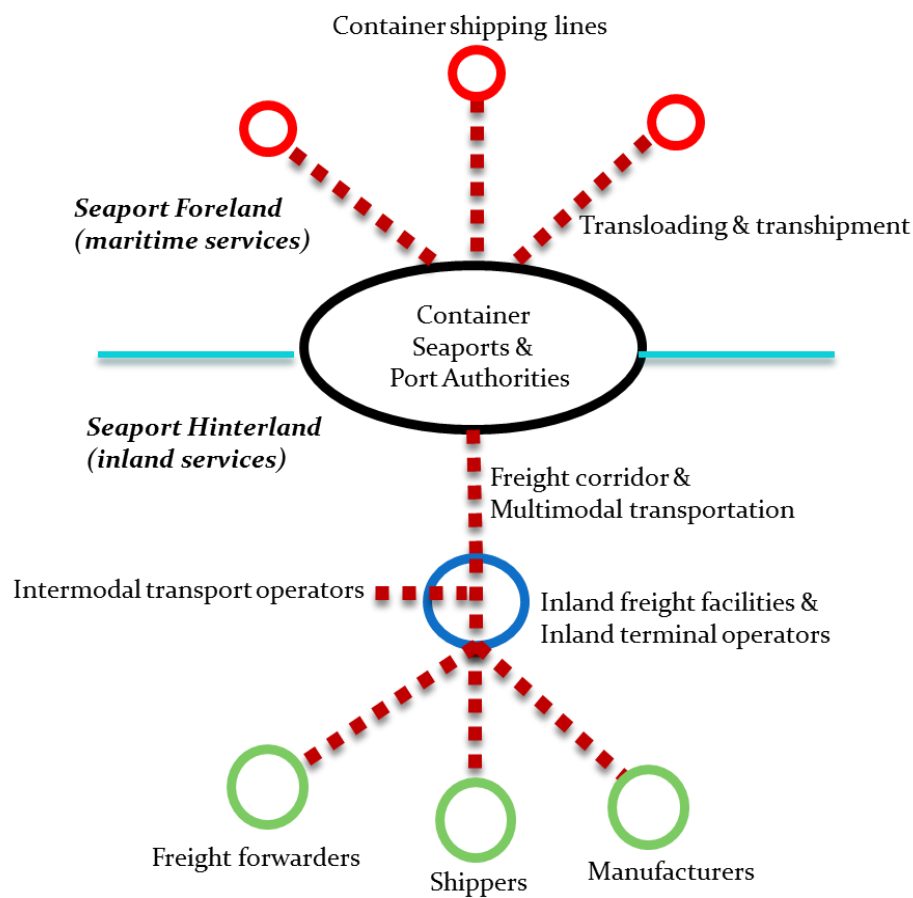


Figure 2.3: Components and players in a container seaport system
Source: Adapted from Notteboom and Rodrigue (2005)

There are impacts of dry ports on seaports. Firstly, the increase in volume in container seaports and the requirement for larger investments in terminal facilities makes seaports need the network with other operators to improve their competitiveness by fulfilling the demand put on them by various stakeholders. This demand can be fulfilled by increasing

the scope of services offered and by providing similar services in adjacent locations (Lun & Cariou 2009). Providing similar services in adjacent locations directly defines the functionality of dry ports (Roso 2008). Dry ports as inland freight facilities or intermodal terminals and a part of a container seaport's system have the potential to support seaport operations and achieve competitiveness due to the changes in their environment.

The internationalisation of container trade, modernising the container terminal operators with resourceful facilities, possessing experience in managing container terminals and having expertise in various positions are important factors in developing a seaport business (Lun & Cariou 2009). Therefore, container seaport systems transform their static supply chain into an adaptive business network to increase their competitiveness and robustness to facilitate the supply chain in the global transport system (Vervest & Li 2009). The latest vessel of the Maersk Line, Triple E, has the capacity to accommodate almost 18,000 TEUs and progress in seaports and hinterland operations must become compatible. Conversely, support from dry ports can assist seaports in fully realising the economies of scale (McCalla 2007; Taneja et al. 2013).

Competition prompts seaports to change their strategies and create competition between transport chains (Horst & de Langen 2008). Intra-regional seaport competition leads seaports to seek out business opportunities in competitor seaport hinterlands and thus deep hinterland connections become vital in this competitive environment (Rodrigue et al. 2010). Increase in seaport competition has placed seaports at a risk when shipping companies move to other seaports. Hence, Roso and Lumsden (2010) argue that seaports have to become competitive in all areas including their hinterland operations by extending their gates through dry ports where flows are effectively manageable, as shown in Figure 2.4. Of notice is the modal shift or transportation interface in dry ports which contribute to

a cooperative freight distribution network and which has a significant effect on the environment, social, economic benefits, reduction of congestion and improve the competitiveness in seaports without physical expansion to the site (Wisetjindawat et al. 2007: Roso 2007).

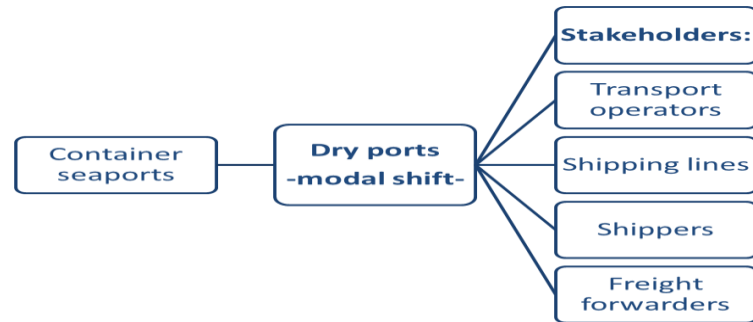


Figure 2.4: Dry ports as an extended gate in the container seaport system
Source: Adapted from Roso and Lumsden (2010)

2.3 Development of dry ports

The development of a regional transport network depends on all forms of transport linkages, such as railway, roads and waterways, connecting with transport nodes such as seaports and dry ports. The dry port network greatly facilitates trade and allows containers to be distributed between transport modes and ensures the optimal usage of networks (Woxenius et al. 2004). The growth of transport networks along with dry ports contributes to the reduction in transportation cost as well as transit time, which attract more investment to logistics, manufacturing and service industries in the surrounding areas of dry ports (UNESCAP 2010). As a result, it may attract more investments or incentives for developing transport infrastructure including dry ports.

Given the growing significance of dry ports in the container transport network, the following sections will discuss dry port development, including its definition, types, functions and roles.

2.3.1 Definitions of the term dry port

The term ‘dry port’ was first used by UNCTAD (1982, p.2), stating that a dry port is ‘an inland terminal to which shipping companies issue their own import bills of lading for import cargo assuming full responsibility of costs and conditions and from which shipping companies issue their own bills of lading for export cargo’. At this time, dry ports perform as an inland terminal within a country with or without seaports (UNCTAD 1982). This definition indicates that dry ports can be developed and operate in coastal and landlocked countries.

In 1991, the United Nations defined dry ports as a customs clearance depot located inland away from seaport(s) and to which maritime access is given (UNCTAD 1991). This definition emphasises the customs clearance facilities, and the location of dry ports inland as a key principle for dry port operation. After a decade, a dry port was defined as an inland terminal directly linked to a seaport (UNECE 2001). This term focuses on the function of a dry port as an extended gateway of a seaport as it imitates the function of a seaport existing inland.

Ng & Gujar (2009) define dry ports based on their core functions, multimodal transport connections, and the involvement of the private and public sectors in assisting stakeholders. They stated that a dry port in an inland setting with cargo-handling facilities allows various functions to be carried out to facilitate the interactions between different stakeholders along the supply chain. Further, Roso et al. (2009, p.4) have provided a comprehensive definition of dry ports, that is: ‘an inland intermodal terminal directly connected to seaports with high capacity transport means, where customers can leave and pick up their standardised units as if directly to seaports’.

From a logistic perspective, dry ports have been redefined as logistic nodes which improve cost-efficiency, environmental performance and the logistic quality of hinterland connections (Woxenius & Bergqvist 2010; Cullinane & Wilmsmeier 2011). This definition indicates the aim of dry ports which focuses on efficiency and the excellence of the hinterland network. Additionally, UNESCAP (2012, p.4) defined dry ports as ‘an inland logistic centre connected to one or more modes of transport for the handling, storage and regulatory inspection of goods moving in international trade and the execution of applicable customs controls and formalities’. Table 2.1 summarises the abovementioned definitions of dry ports. The variations in definition indicate that dry ports are defined based on their basic functions and location in 1980s, and this has shifted towards transportation connections, space capacity and documentation clearances in 2012.

Over the years, owing to the practice, functions and facilities used, dry ports and other terms for inland terminals are used interchangeably such as inland container depot, container freight station, inland container yard, and freight village (UNESCAP 2012). The different terms are used depending on the services offered and the role of the inland terminals (Anderson & Roso 2016).

Table 2.1 Variation in dry port definitions from 1982–2012

No	Author(s)	Definition(s)
1.	UNCTAD (1982)	An inland terminal to which shipping companies issue their own import bills of lading for import cargo assuming full responsibility of costs and conditions and from which shipping companies issue their own bills of lading for export cargo.
2.	Beresford & Dubey 1990; UNCTAD (1991)	A customs clearance depot located inland away from seaport(s) giving maritime access to it.
3.	UNECE (2001)	An inland terminal which is directly linked to a seaport.
4.	Ng & Gujar (2009)	An inland setting with cargo-handling facilities to allow several functions to be carried out, for example, consolidation and distribution, temporary storage, custom clearance, connection between transport modes, allowing agglomeration of institutions (both private and public) which facilitates the interactions between different stakeholders along the supply chain.
5.	Roso et al. (2009)	An inland intermodal terminal directly connected to seaport(s) with high capacity transport mean(s), where customers can leave/pick up their standardised units as if directly to a seaport.
6.	Woxenius & Bergqvist (2010), Cullinane & Wilmsmeier (2011)	A logistic node which improves cost-efficiency, environmental performance and the logistic quality of hinterland connections.
7.	UNESCAP (2012)	An inland location logistic centre connected to one or more modes of transport for the handling, storage and regulatory inspection of goods. Moving in international trade and the execution of applicable customs controls and formalities.

Source: Compiled by the author

The entity described as a dry port also varies worldwide in scale, complexity and area of specialisation (Roso & Lumsden 2010). For example, in terms of country, the term inland ports is used in America (Rodrigue 2011), forward ports in Africa (Ahamed 2010), and inland container depots in India (UNESCAP 2006). In terms of the functions and facilities, and the role of the inland terminal, inland container depots (ICD), container freight stations (CFS), inland container yards and a freight village are used. Table 2.2 shows a distinction between the terms of inland terminals (see table 2.2), which is explained as follows.

An inland container depot (ICD) is a ‘A common user facility, other than a port or an airport, approved by a competent body, equipped with fixed installations and offering services for handling and temporary storage of any kind of goods (including containers) carried under customs transit by any applicable mode of transport, placed under customs control and with customs and other agencies competent to clear goods for home use,

warehousing, temporary admission, re-export, temporary storage for onward transit and outright export' (UNECE 1998, p.3).

An ICD provides facilities such as container yard, container freight station, bonded and non-bonded storage, customs and container repair facilities to the clients. An ICD offers services for handling containers and storage, break-bulk cargo handling and storage, and value adding services to their clients (UNESCAP 2009). However, based on the services offered, an ICD gives less priority to non-containerised cargo.

A container freight station (CFS) aggregates stakeholders' consignments into containers and there is no site restriction in terms of location for container freight stations because this terminal can be located inside, outside or far away from seaports (Woxenius et al. 2004). The facilities provided by the CFS are space for container freight and bonded and non-bonded storage. Services provided by this terminal are container stuffing and de-stuffing, freight forwarding and consolidation (UNESCAP 2009). The services offered by the CFS are space oriented with less focus on customs clearance and container management facilities.

Table 2.2: Differences between dry ports and other inland terminals

Table 2.2: Differences between dry ports and other inland terminals										
Intermodal terminals	Component of facilities									
	Container yard	Container freight station	Break bulk storage	Bonded storage	Non bonded storage	Bulk storage	Customs	Repair facilities	International trade	Domestic trade
Inland container depot	√	√	-	√	√	-	√	√	√	√
Container freight station	-	√	-	√	√	-	-	-	-	-
Inland container yard	√	-	-	-	-	-	-	√	√	√
Freight village	√	√	√	√	√	-	√	√	√	√
Dry ports	√	√	√	√	√	√	√	√	√	√
Component of services										
Intermodal terminals	Container handling and storage	Container stuffing and de-stuffing	Non-containerised break-bulk cargo handling/storage	Bulk cargo handling and storage	Customs inspection and clearance	Freight forwarding and cargo consolidation	Financial services	Inventory management and materials handling		
Inland container depot	√	√	-	-	√	√	√	√		
Container freight station	-	√	-	-	-	√	-	-		
Inland container yard	√	-	-	-	-	-	-	-		
Freight village	√	√	√	-	√	√	√	-		
Dry ports	√	√	√	√	√	√	√	√		

Source: Adapted from Woxenius et al. (2004); UNESCAP (2006); Rimienė and Grundey (2007); Roso et al. (2009); UNESCAP (2009)

An inland container yard provides storage, cleaning, and repair of empty containers. It is located near to the main seaport terminal or other logistic centres as a way to improve services and handling turnaround time (Rimienė & Grundey 2007). Inland container yards provide basic facilities to the clients such as container yard space, container repair facilities, and to facilitate the clients in domestic and international trade (UNESCAP 2009). There are no customs clearance services and value adding activities in this type of terminal.

A freight village is an area of land dedicated to a number of transport and logistic facilities, activities and services, which are not just co-located but also coordinated to encourage

maximum synergy and efficiency (Galloni 1999; Nam & Song 2011). Distinguishing features include an intermodal terminal and shared access to facilities and services (Rimienè & Grundey 2007). Normally a freight village is located in a metropolitan area and at the key nexus of a transportation hub to boost the access of human capital, reduce truck legs and lead to capacity sharing among other players (Higgins & Ferguson 2011).

In order to encourage intermodal transport for the handling of goods, a freight village must preferably be served by a multiplicity of transport modes such as road, rail, deep sea, inland waterway and air (Galloni 1999; Nam & Song 2011). A freight village provides facilities for container management, bonded and non-bonded storage, customs, and facilitates international and domestic trade as shows in Table 2.2. In terms of services, a freight village provides storage for containerised and non-containerised cargo, freight forwarding, customs inspection and financial services (UNESCAP 2009).

Dry ports can provide all the services of a seaport except for the loading and unloading of cargo to and from seagoing ships. In comparison to container depots, dry ports can accommodate all types of cargo and not just containers (UNESCAP 2009). Simplification and flexibility does not occur in other intermodal terminals which only provide fundamental services with the basic facilities to the stakeholders (Ng & Gujar 2009). Furthermore, the services and facilities offered by dry ports are extensive compared to other intermodal terminals. This indicates that the roles of dry ports are various and broad, compared to other intermodal terminals.

Figure 2.5 illustrates the typology of various inland terminals. Based on the central tendency measurement on the input in table 2.2, a dry port has become an important intermodal terminal in container seaport operations because this particular terminal possesses a range of services, functions and facilities compared to other intermodal

terminals. Inland container yards have limited services, functions and facilities compared to others. Therefore, dry ports can be more effective intermodal terminals which highly replicate the function of seaports but in various inland locations.

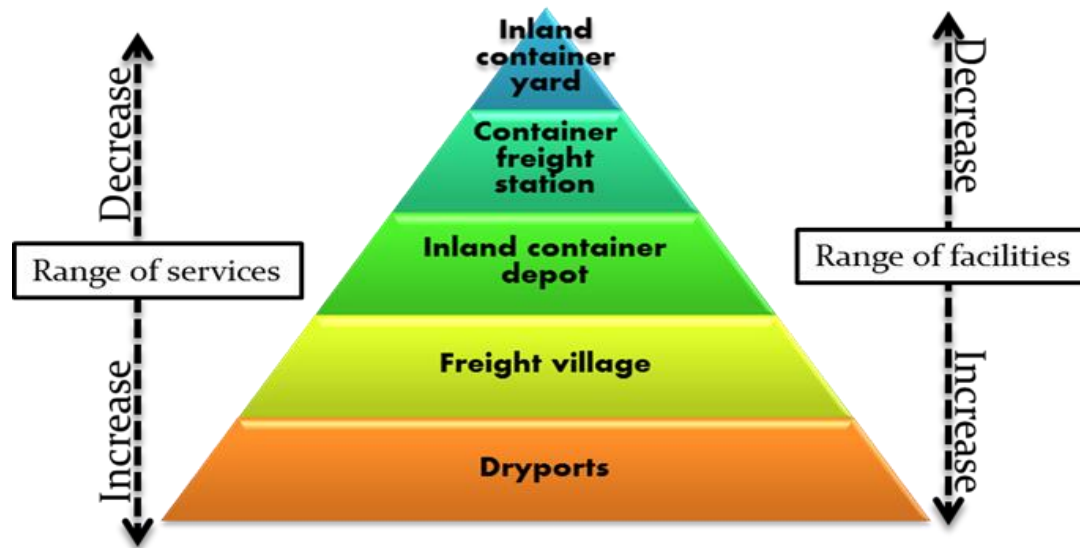


Figure 2.5: Hierarchy of dry ports in inland terminals

Sources: Adapted from UNECE (1998); Woxenius et al. (2004); Rimiene and Grundey (2007); UNESCAP (2008); Ng and Gujar (2009)

2.3.2 Types of dry ports

Dry ports are categorised based on the distance from seaports and their locations inland (Roso 2008; Beresford et al. 2012). Close, mid-range and distant are three types of dry port classified by their distance from seaports (Table 2.3). Close dry ports are located less than 50 km from seaports, relatively near seaports. Therefore, the transport distances are fairly short; inbound and outbound cargo are mostly transported by road (Roso & Lumsden 2010). Close dry ports are specially designed to mitigate space and capacity constraints faced by seaports, overcome local traffic problems and consolidate road transport to and from seaports for clients outside the city area (Roso et al. 2009).

Mid-range dry ports are located approximately 50 to 150 km from seaports and are generally covered by road transport (Roso et al. 2009). This type of dry port serves as a consolidation centre for the seaport and acts as a buffer relieving zone to the seaport. Mid-range dry ports are normally located near to the industrial area and increase the intermodal transportation between the industry zone and the seaport.

Distant dry ports are located more than 150 km from seaports and close to the hinterland or borders (Roso et al. 2009). The transport distance between the seaports and dry ports is much larger, and inland shipping and rail become more competitive on these longer transportation distances. Being located far away from the seaport is not a serious issue for this type of dry port as long it alleviates road congestion, increases inland accessibility, strengthens multimodal solutions, avoids traffic bottlenecks, reduces pollution and fulfils the needs of all stakeholders (Ecorys 2011).

Basically, the importance of dry ports as a common user facility is that they promote the transfer of goods from origin to destination without intermediate customs examination, known as the concept of through-transport (Beresford & Dubey 1990; Beresford et al. 2012). The existence of dry ports reduce cargo dwelling time in container seaports and alleviate common causes of delay such as long processing and administration procedures and poor handling in the congested seaport area (Kunaka 2013). The presence of dry ports reduces seaport congestion, and it significantly contributes to a reduction of carbon dioxide emissions at the seaport's gates and its surroundings (Roso 2008).

Table 2.3: Characteristics of distance-based dry ports

Specification:	Close Dry Ports	Mid-range Dry Ports	Distant Dry Ports
Activities	• Transit	• Rail link between seaport and market	• Rail link between seaport and market
Location	<ul style="list-style-type: none"> • Decongestion of city access • Reduction of pollution • Increased intermodal transportation 	<ul style="list-style-type: none"> • Region attracts industries • Increased intermodal transportation 	<ul style="list-style-type: none"> • Acquiring new hinterland of the seaport • Increased intermodal transportation
Infrastructure	<ul style="list-style-type: none"> • Reduction of road maintenance costs • Rail infrastructure development 	<ul style="list-style-type: none"> • Reduction of road maintenance costs • Rail infrastructure development 	<ul style="list-style-type: none"> • Reduction of road maintenance costs • Rail infrastructure development
Transport	<ul style="list-style-type: none"> • Activity reduction from /to seaports • Reduction of waiting time for transport operators 	<ul style="list-style-type: none"> • Coordination with rail traffic • Reduction of waiting time for transport operators 	<ul style="list-style-type: none"> • Decrease of transport costs • Coordination with rail traffic
Logistic	<ul style="list-style-type: none"> • Increased inland access and city distribution • Intermodality 	<ul style="list-style-type: none"> • Increased inland access • Decrease of costs 	<ul style="list-style-type: none"> • Increased inland access • Cost reduction

Source: Adapted from FDT (2007)

Beresford et al. (2012) categorised dry ports based on their location, as seaport- based, city-based, and border-based dry ports (Table 2.4). Firstly, seaport-based dry ports are located near to the seaport and aim to capture a high volume of containers and to relieve seaport capacity constraints. In general, a seaport relies on this type of dry port especially for fast customs clearance and space. Customs clearances usually are vital in this type of dry port because they can reduce the lead time. This dry port has a low level of value adding services because it focuses on container clearance and consolidation. Basically the core functions of this dry port are to enhance modal shift, provide fast pre-customs inspection and clearance, and provide space for container storage (Wang 2009).

Secondly, city-based dry ports are located within a larger logistic cluster which this terminal serves in terms of production and consumption. In contrast to a seaport-based dry port, this type of dry port focuses on a wider range of value adding services (Beresford et al. 2012). City-based dry ports are normally situated in logistic parks, manufacturing zones or production areas. For this reason, high accessibility, transportation facilities and a

location near to city gateways are required. Moreover, they have sufficient land for future expansion and large facilities with various functions; and they tend to be located in metropolitan areas and mainly serve manufacturers and distributors (Beresford et al. 2012).

Thirdly, border-based dry ports are located at border areas of a nation. The functions of this type of dry port are being a transshipment centre and providing customs clearance service to the stakeholders (Beresford et al. 2012). A border-based dry port performs as a connecting centre for inland freight distribution with different hinterlands, and is generally located in the border areas of particular countries that are a long distance from seaports. Therefore, border-based dry ports mainly serve domestic trade by road and rail to boost cross border trade development and they smoothen the supply chain system in landlocked countries (Beresford et al. 2012). The main responsibilities of border-based dry ports are enhancing domestic trade and international distribution, providing value adding services, space for containers, and supplying logistic services to stakeholders (Zou 2009).

Table 2.4: Characteristics of location-based dry ports

Specification	Seaport-based dry port	City-based dry port	Border-based dry port
Activities	<ul style="list-style-type: none"> • Customs clearance and consolidation capacity • Extended gateway 	<ul style="list-style-type: none"> • Regional production area • Inland gateway 	<ul style="list-style-type: none"> • Cross border and domestic trade
Location	<ul style="list-style-type: none"> • Near to seaport 	<ul style="list-style-type: none"> • Urban area 	<ul style="list-style-type: none"> • Border area and away from seaport
Infrastructure	<ul style="list-style-type: none"> • Cargo loading and discharging • Express customs clearance • Low range of value adding services 	<ul style="list-style-type: none"> • Large facilities with diverse function • Require sufficient land for expansion • High range of value adding services 	<ul style="list-style-type: none"> • Transshipment centre • Customs clearance
Transport	<ul style="list-style-type: none"> • Starting point for modal shifting 	<ul style="list-style-type: none"> • Long distance from seaport requires high access to 	<ul style="list-style-type: none"> • Mainly serves domestic and international trade by road and rail

transport network			
Logistic	<ul style="list-style-type: none"> • Targeting of distributors operating on a JIT basis 	<ul style="list-style-type: none"> • Target both manufacturer and distributors with medium order lead time 	<ul style="list-style-type: none"> • Serves by road and rail to link inland freight distribution system in different hinterland

Source: Adapted from Beresford et al. (2012)

2.3.3. Roles of dry ports

The role of dry ports is considered by the part it plays in the container seaport system, while the function of dry ports refers to what the dry ports operate. This section and 2.3.4 discuss the role and functions of dry ports according to the literature.

The development of dry ports in a region has become a factor that stimulates further development of transport nodes such as seaports, airports and other intermodal terminals. Improvement in intermodal transportation is important in promoting the emergence of intermodal terminals. The role of dry ports depends on demand from its clients, the aims of the investors, distance from seaports and its clients, and its capacity in terms of facilities and infrastructure (FDT 2007; Roso et al. 2009; Beresford et al. 2012). Reviewing the relevant literature, this research classifies the role of dry ports as an extended gateway for seaports, an integrator for intermodal transportation, a freight platform, and the promoting of the regional economy, which are discussed in the following.

2.3.3.1 An extended gateway for container seaports

The role of dry ports as an extended gateway of container seaports refers to seaport functions, such as container storage, consolidation, customs clearance and logistic services including value adding services which are undertaken by dry ports because they have more space available to them than congested seaports (Veenstra et al. 2012a). Implementation of a dry port creates a seamless seaport inland access, imposing effective transport flow with one interface in the form of the dry port concept instead of two, with one being the seaport

and the other the inland destination (Roso & Lumsden 2009). The existence of the dry port performing the function of the seaport in the hinterland manages to explore another solution that balances multimodal transportation options, reduces regional and terminal congestion and other negative externalities associated with freight and logistic.

Dry ports assist seaports in responding to some of the issues in container terminals, such as changes in trade patterns that take advantage of changing freight and logistic processes, and they promote intermodal transfer close to the production market (Weisbrod et al. 2002). As an extended gate for seaports, dry ports have a great prospective to reduce trips of unloaded trucks inland. For example, almost 30% of empty trucks were detected in Pakistan and almost 43% of trucks in China were moved by road without containers (Zanni & Bristow 2009). Space provided by dry ports inland reduces empty container movement, and the utilisation of rail for container rotation improves the container cycle in the market.

Dry ports assist and increase the capacity and efficiency of seaports by improving the hinterland distribution associated with multimodal connectivity (Ngoc et al. 2011). The existence of dry ports will not only be an advantage from a domestic perspective, but will also facilitate the development of cross border transport infrastructure and simplify border crossing procedures (Song 2003). The association of dry ports in seaport systems will be an added advantage to seaports in transforming them from regional seaports to international hubs with an effective and efficient transportation system (Nemoto 2009).

2.3.3.2 An integrator of intermodal transport systems

Dry ports are normally considered for development at a location with various transport links such as highways, railways and inland waterways. Therefore, dry ports function as an

integrator of various modes of transportation by encouraging intermodal transport operations (Kaproos 2003; UNESCAP 2009). Intermodal transport is an integrated process where all parts of the transport process, including organisational and technological arrangements must be well connected and coordinated to produce significant proven advantages compared to single mode transportation (Kaproos 2003; Monios 2016). The combination of two or several transportation modes via dry ports lowers both costs and transit time for containers and improves the quality of the transport service (Bichou 2009).

Dry ports support the improvement of transport services in the container freight system by promoting intermodal transportation. They provide more choices to the customers and time and cost advantages to key players in the system (Smith 2003). For example, to uphold 'on time' freight services, the quality and reliability of railway freight operations and road freight distribution services must be improved. The improvement in road and rail transport services produces advancement in door-to-door service and high integration of the railway system with the existing logistical network (Ballis & Golias 2002). The integration between railways and other transport modes at dry ports are important to encourage modal shift during container distribution to and from seaports.

2.3.3.3 A freight platform

The presence of dry ports reduces transport processes within cities and urban areas (Regan & Golob 2005). Urban freight transport involves the delivery and collection of goods in town and city centres and includes activities such as goods handling, storage, inventory management, as well as home delivery services (Allen 2007). The mobility of these types of goods has a major impact on the accessibility and the attractiveness of the region. However, the existence of dry ports as an urban freight consolidation centre promotes these terminals for the optimisation of logistic operations, urban traffic reduction, as well

as encouraging modal shift and multi-company consolidation within the urban periphery (Regan & Golob 2005). Moreover, the role of dry ports as freight platforms reduces container traffic in the city which in turn minimises the consumption of urban space for transport infrastructure and contributes to general improvement of the urban environment (Visser 2006). Focusing on distribution efficiency and its urban orientation, dry ports as centres for urban consolidation and distribution provide an interface between the transshipment of long-distance traffic to short distances (Visser 2006).

Dry ports can perform a single or multiple roles in the freight platform for urban freight consolidation and distribution, as depicted in Figure 2.6. Bundling the various trips of one or several carriers into single linked trips with better capacity utilisation, the time gained and delivery schedules become more reliable. The role of dry ports as a freight platform inland allows seaports to extend their influence to become competitive regional consolidation and distribution nodes (Allen 2007).

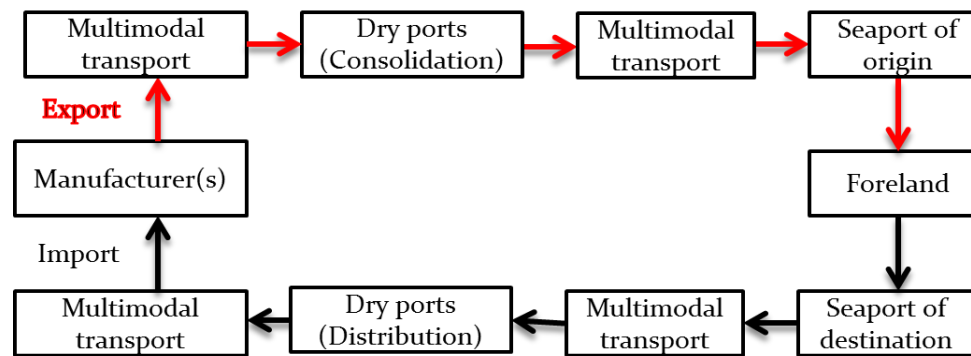


Figure 2.6: Dry port as having a single or multiple roles in the freight platform
Source: Adapted from Visser (2006)

2.3.3.4 Promoting the regional economy

The development of dry ports encourages trade and contributes to the growth of the regional and national economy. Well-positioned dry ports are able to attract industries to their surrounding area and utilise available land, labour and facilities, which expand a seaport's hinterland and promote regional economy for a nation (Garnwa et al. 2009). The

presence of dry ports creates job opportunities, for example in the transport sector such as rail as a result of modal shift. It is evident that in some less-developed countries, the development of dry ports is beneficial to the regional economy by offering jobs, investments, and development in transport infrastructure (Rodrigue & Notteboom 2009).

Services provided by dry ports facilitate trade and allow local manufacturers and shippers to have easy access to international and national markets. The tendency to use dry ports improves investment in the expansion of capacity and infrastructure. The dry port territory faces many changes especially in upgrading the transport corridor which combines local, regional and international traffic lanes (Wilmsmeier & Zarzoso 2010). The development in the multimodal transportation facilities nearby dry ports allows seaports, freight forwarders, shippers and other stakeholders to promote imports and exports of a region. New market development becomes possible as both imports and exports become cheaper, more reliable and efficient through the support of dry ports (Rodrigue & Notteboom 2009).

2.3.4 Functions of dry ports

The functions of dry ports are clustered in terms of the services that they provide, depending on their capacity, location and transport modes connected. These characteristics are important in planning the functions of dry ports in accordance with existing and forecasted market demands (FDT 2007; Bergqvist 2016). As indicated in table 2.2, dry ports provide a range of services such as container handling and storage, container stripping and stuffing, break bulk cargo handling and storage, bulk cargo handling and storage, customs inspection and clearance, container light repairs, freight forwarding and cargo consolidation services, inventory management and materials handling, and banking/insurance/financial services. Based on these services, the function of dry ports can

be categorised into four main functions including transport, logistic, value adding and administration.

The transport function requires the dry port to function as a transfer unit from one mode of transportation to another. Facilities to connect various modes of transportation and provide ample space to accommodate a high volume of containers are necessary so that transfer is a less time-consuming operation (Bergqvist 2016). The function of dry ports as an intermediary between seaports and traders determines the services that they provide (UNESCAP & KMI 2007). Although the benefits gained from dry ports differ between the stakeholders, they are all concerned about modal shift or a combined transportation concept to reduce cost and smooth traffic flow. Shippers seek to reduce inland transportation costs to achieve a reduction in supply chain costs (Fremont & Franc 2010).

The logistic function of dry ports reflects their capability to replicate seaports in order to perform as an extension of them (Roso & Lumsden 2010). Providing logistic functions such as warehousing, consolidation and deconsolidation and facilities for stuffing and unstuffing are essential for dry ports (UNESCAP 2010).

The ability of dry ports to perform a value adding function means their ability to add value to cargo in the containers during operations and via customised services (Bergqvist 2016). Capacity to provide a logistic service, labelling, re-packing, container weighing, fast adaptation to altering schedules and the capacity to provide new customised services are some of the examples of value-adding services for which stakeholders have high demand (Song & Panayides 2008).

The range of services that dry ports supply to clients are not exhaustive, as the logistic sector is in a constant state of flux and new services may be introduced from time to time

(Gray & Kim 2001). Therefore, the services dry ports provide depend on the needs of the stakeholders in the supply chain (UNESCAPE & KMI 2007) and not all dry ports have to provide all functions. As a provider for the value adding function, dry port operators need to be proactive by providing a range of services according to the current situation, trends and there are no restrictions in performing these set of functions or activities.

Being an extended gateway to the seaport, the dry port must play an administrative function for seaports and their clients. Customs clearance is the main component in this function (Beresford et al. 2012). However, immigration, quarantine, police inspections, safety and security are required to facilitate legitimate transactions within or beyond their borders (UNESCAP 2012; CDP 2013). A dry port performing all of these functions enriches the trust and confidence of stakeholders to use this logistic centre for their business purposes (Woxenius et al. 2004) and strengthens the dry port's position in the container seaport system.

2.4 Challenges of global dry port development and strategies

Based on the existing literature about worldwide dry port development, this section discusses the major challenges that dry ports face in different countries in Europe, America, Africa and Asia, and it outlines some strategies for overcoming these challenges. Challenges include issues related to transport infrastructure and operations, information sharing, competition, location and other issues.

2.4.1. Issues in transport infrastructure and operations

Major issues relating to transport infrastructure and operations are limitations in connectivity and accessibility due to insufficient transport infrastructure, difficulties in short distance container delivery, imbalances in modal split, and congestion in dry ports. These are discussed in the following sections.

2.4.1.1 Limited connectivity and accessibility due to insufficient transport infrastructure

Limitations in transport infrastructure affect a dry port's accessibility and connectivity, and therefore reduce its capability to support seaport operations. Dry ports with limited transportation networks for container distribution lose their attractiveness in the container seaports system and add additional pressure to seaports in executing regionalisation inland (Roso et al. 2009; Leszek & Fechner 2012; Arvis et al. 2010). Insufficient transportation infrastructure blocks dry ports in connecting with manufacturers or seaports, and affects the continuity of containers to the dry port. This indicates that the transportation networks of a dry port can determine whether it is in a good strategic location or not. For example, Amal dry port in Sweden recorded a low volume of container throughput from 2005, with only 2000 containers coming through per year due to a limitation in connectivity (Roso et al. 2009). This was due to poor transportation links in facilitating container freight to and from the dry port and the seaports (Woxenius and Bergqvist 2010).

Consequently, the Amal Municipality decided to shift Amal dry port to another location with better transportation infrastructure (Roso et al. 2009). Shifting a dry port from one location to another with better transport links therefore can be a strategy for improving a dry port's connectivity to and from seaports. Moreover, location shifting may be a good solution, having lower costs compared to transport infrastructure development, which is much more consuming of time and money.

Another example is Mandalay dry port in Myanmar. The nation has the poorest internal transportation linkages in Asia (Black et al. 2013), and this has created substantial barriers to its dry port operations. Although the aims of the Mandalay dry port are to reduce

transport costs and increase the momentum of container delivery, it was unable to achieve this because of limited transportation development, leading to poor transport connectivity. According to Doust and Black (2009), the participation of the government in the container seaport system is always essential for providing sufficient transport connectivity, and it ensures that dry ports are well operated and that they can provide significant benefits to all the players in their network.

Drenthe dry port in the Netherlands faced transport challenges, including poor inland waterway access, low capacity in the rail link between the dry port and seaports, and a limited length of rail track. As a result, it was unable to meet client expectations to offer frequent rail services, including crossborder rail services, which would have allowed a higher volume of cargo to be transported at lower costs. The dry port users required the presence of a logistic provider in the dry port to expand their network and generate sufficient volumes (Ecorys 2011).

In order to remain sustainable in the seaport system, this dry port will need to introduce the necessary infrastructure and services to its clients. Infrastructure includes wide roads and rail networks for improving the volume of containers generated to seaports. Moreover, dry port users require sufficient transport infrastructure to accommodate large volume containers to and from seaports (Visser et al. 2009). This promises the dry port users benefits from the economy of scale, which subsequently provides cost advantages to users. Kapros (2003) argues that transportation options via rail, road and inland waterways promise low transportation costs and faster delivery compared to dry ports, which are highly dependent on a single mode of transportation.

2.4.1.2 Difficulty for short distance container delivery

There is a challenge for dry ports in the fact that haulier operators are reluctant to deliver and pick up containers at dry ports for short trips. For example, Poznan dry port in Poland operates as a gateway hub to transfer containers from North Range European seaports such as Hamburg, Bremerhaven, Rotterdam, Antwerp and Poland to the markets of Russia and the Ukraine, and vice versa (Leszek & Fechner 2012). The main challenge faced by Poznan dry port was a difficulty in delivering containers within a very short distance from the dry port, i.e. zone 1, less than 35 kilometres away, because the hauliers assumed that operating in zone 1 was less profitable and uneconomical compared to operating for longer distances i.e. zone 2 (36-50 kilometres), zone 3 (51-80 kilometres), zone 4 (81-100 kilometres) and zone 5 (more than 101 kilometres) (Fechner 2010).

To overcome this issue, Poznan dry port organised a multi-group train system to distribute containers from different zones. This strategy utilised train services to cover the entire zone for container distribution, avoiding traffic in the city and reducing the damage to road infrastructure (Leszek & Fechner 2012). In addition, road conditions in certain areas, especially in Garbary, were not suitable for high-tonnage vehicle traffic. The utilisation of the train network through a multi-group train system and inland waterway in Garbary has been effective for container distribution and collection (Fechner 2010). The availability of several transportation modes for container transportation in dry ports may overcome several of these issues without the burden of any additional maintenance cost to road infrastructure. It also can prevent the monopoly of a particular mode of transport for freight. It is the main reason that transport infrastructure has become one of the key requirements for dry port operations.

2.4.1.3 Imbalance in modal split

Imbalance in modal split refers to the domination of single transportation mode during container distribution and pick up, compared to other modes. A good example of this is the domination of road freight transportation against rail freight transportation in City Deep dry port, South Africa. This dry port faced an imbalanced proportion of modal split because of an inadequate and unreliable capacity in the railway system, frequent delays of trains to the dry port as a result of container checking and splitting and ‘unpredictable’ turnaround times for train services. The proportion of modal share between road and rail was 70:30 (Arvis et al. 2010). The limitations in rail freight provided an advantage to road freight so that it came to dominate the container freight transportation from City Deep to Durban seaport. In South Africa, the proportion of modal split needs to be balanced for efficient container transportation, especially to land-locked countries, because the domination of road freight transportation makes the cargo become much less competitive at the consumer destination (Kunaka 2013).

Some strategies are required for improving modal share, such as upgrading the train services in terms of capacity and frequency, and developing train infrastructure to balance road and rail freight transportation to ensure efficiency and effectiveness. According to Kunaka (2013), the development of train infrastructure could potentially reduce train turnaround times and raise more confidence among clients in utilising the railway network.

Besides encouraging the development of rail capacity and frequency so as to reduce the domination of road freight, innovation in containerisation may improve the proportion of rail freight. For example, Lat Krabang inland container depot in Thailand faced the issue of an unbalanced proportion of rail freight by recording the ratio of 3:1 between road and rail freight (Hanaoka & Regmi 2011). To increase the ratio of the rail service, a temperature-controlled containerisation service was introduced for the outbound movement of perishable containers (Hanaoka & Regmi 2011). Although the capacity of

rail needs to be improved to increase the proportion of rail freight modification in containers can be done to utilise rail transportation and improve the usage of dry ports in the container seaport system.

2.4.1.4 Congestion in dry ports

Dry ports can help to ease the congestion issue at seaports (Monios et al. 2016). However, there are some city-based dry ports facing congestion issues due to limited transport capacity and space availability. For example, the Virginian inland port faced a congestion issue because of an increasing container volume in the Virginia seaport, and this spread to the major interstate corridors and influenced international traffic through the same network (Bruce et al. 2013). This situation indicates that the further development of transport infrastructure is important for dry ports so that they can assist seaports in reducing congestion.

To overcome congestion, The Swedish Transport Administration established a regional distribution centre for segregating the volume of containers to various distribution centres, through a system of varying transportation accesses. The consolidation of international and domestic cargo to other networks generated a sufficient cargo volume, produced traffic flow changes, and attracted a high participation by service providers in seaport systems (Bruce et al. 2013). In addition to the development of a new capacity in distribution networks, the enhancement of existing capacity was another option. For example, the introduction of a double-stack rail service for increasing the efficiency of rail frequency and capacity reduced the congestion issue and enhanced modal split at this dry port (Roso & Lumsden 2009). The development of a regional distribution centre and the introduction of double stack rail services can increase the capacity of dry ports to accommodate additional volumes of containers, as well as executing the inland transshipment procedure.

2.4.2. Information sharing

Information sharing can encourage effective inland-based freight distribution (Monios et al. 2016). However, there are issues related to information sharing among dry ports and other players for container freight distribution, and these affect the performance of dry ports as well as influence the competitiveness of container seaports (Horst & Langen 2008; Dotoli et al. 2010; Trainaviciute 2009). A lack of information integration is a main issue related to information sharing between dry ports and other actors in the container freight distribution system.

A dry port is an inland terminal that handles standardised units of goods such as containers, therefore they focus on the application of standardised procedures by all players during container transactions. According to Roso et al. (2015), the implementation of systematic cargo handling procedures for container distribution can reduce a significant amount of paperwork and increase viability in using dry ports.

Complications of data handling along the container seaport system can affect the performance of dry ports. For example, the main challenges that the dry port in Valencia, Spain, faced were a lack of standardised procedures between them and their stakeholders, a misperception in the roles of the different stakeholders, inconsistencies in information, and inadequate planning for dry port operations (Horst & Langen 2008). These issues affected the role of this dry port and caused it many difficulties in integrating different clients and administrating information along the chain. According to Roso et al. (2009), the lack of a data handling procedure causes container trading procedures to become complicated. Besides that, they cause delays and affect the performance of the players in the container seaport system.

To overcome these challenges, a Port Community System (PCS) was implemented to integrate different stakeholders in seaport operations including dry ports, by giving them support in managing their information exchanges as well as their administrative procedures. PCS covers the information from the various stakeholders, especially from shippers, rail operators and seaports. This system produced integration and coordination between the dry ports and its clients (Dotoli et al. 2010). This intermediate platform simplified the information flow, reducing multiple procedures during crossborder transactions and improved the performance of each player along the container seaport system.

The success of information flow in the container transportation chain requires regular updates on information, a uniform language approach, and sophisticated ICT services (Notteboom 2008). Any incomplete or delayed information will put pressure on the freight transport sector. For example, incomplete information about modes of transport and the port of destination/origin from the shipper, carrier, or shipping line could contribute to operational delays in the Muizen and Mouscron dry ports in Belgium (FDT 2007). To overcome this situation, information sharing through an authorised network needed to be implemented. According to Trainaviciute (2009), due to this, dry ports and seaports in Belgium decided to concentrate more on the sharing of information between them.

Another example is Isaka dry port in Tanzania which suffered extreme delays during customs procedures for inspecting border-crossing containers, which contributed to high trade costs and low trade competitiveness (Arvis et al. 2010). The use of advanced ICT via the introduction of the ‘One-Stop Border’ system provided a solution to this problem. This ‘One-Stop Border’ system interlinking customs and border management systems of neighbouring countries reduced clearance times from 5 days to 3 hours (Kunaka 2013).

Also, the development of ICT application in Isaka dry port reduced container dwelling times from 25 days to 4 days (Kunaka 2013).

2.4.3. Competition

Competition with seaports and other inland terminals is another challenge faced by dry ports (Wang 2009; Hanaoka & Regmi 2011; Cullinane et al. 2012). According to Monios et al. (2016), seaports and dry ports need to complement each other, since seaport hinterland connectivity can be enhanced through them.

2.4.3.1 Competition with seaports

In some cases, seaports and dry ports are not keen to cooperate, but tend rather to compete with each other in dominating the container market. For example, Anapolis and Goias are the most important and the largest dry ports in Brazil (Ng et al. 2013). These dry ports contribute to almost 30% of container volume to seaports although they face very high competition from other seaports. Brazilian dry ports face high competition from seaports too, because the main seaport has a very high interest in dominating the hinterland market. Moreover, the competitive relationship between seaports and dry ports has contributed to complications during container transfer from seaports to dry ports (Cullinane et al. 2012). The competition between seaports and dry ports has limited the performance of these dry ports in their seaport system (Ng et al. 2013). To overcome this situation, dry ports have to diversify activities or services and provide more value adding services to manufacturers in order to reduce competition from seaports.

The main strength of dry ports is flexibility and a good location close to consumption or production points inland. These can be used as an advantage to identify requirements of the clients and to fulfil demands accordingly. For instance, Brazilian dry ports have

introduced new strategies for providing better services to their clients, such as suspension in duty payments, immediate customs clearance processes, immediate container unloading to avoid demurrage, the permanent presence of inspection agents, a lower risk of cargo loss and damage, the possibility of partial cargo imports and exports according to company needs, as well as the suspension of duties for international companies (Robles 2013). The implementation of parameterisation in container clearance into different categories has enhanced the speed of the clearance process (Cullinane et al. 2012). The implementation of this new strategy has improved the effectiveness of container transportation to and from the seaport, reducing the competition from other seaports and enhancing Brazilian seaport competitiveness (Robles 2013).

Dry ports and seaports are part of container seaport systems, and competition between them will improve their performance more as a single entity rather than collectively. In some regions such as the USA and India, seaport operators are the investors in dry ports. Hence, if seaports compete with their own subsidiary terminals rather than cooperate with them, they may provide less benefits to seaports, dry ports and in fact, the whole freight system.

There is a strategy on how dry ports can develop a cooperative relationship with seaports. Assisting them by allocating space for containers from seaports may eliminate competition between them. For example, in China, the competition among seaports created pressure on the efficiency of the supply chain network. This factor drove the need for the dry ports to become modern logistic centres located in inland regions with similar functions to coastal seaports (Wang 2009). The development of coastal cities and the high population of cities has increased the need for land. Consequences from this issue include a difficulty for seaports to provide sufficient land for cargo storage. By providing space to accommodate

containers for seaports, dry ports in this region have reduced the capacity constraints faced by the seaports, have helped overcome competition, and have developed a competitive relationship with seaports (Feng et al. 2013).

2.4.3.2 Competition with inland terminals

Besides seaports, dry ports have faced some competition with inland terminals. For example, Lat Krabang inland container depot faced severe competition from the Malaysian Padang Besar Cargo Terminal (PBCT) because of time lost in Laem Chabang seaport, as well as its distant from Bangkok seaport. The demand for PCBT services among manufacturers from southern Thailand is crucial for transporting perishable goods to Penang Port. Based on UNESCAP (2014), the distance from the Lat Krabang inland container depot to Penang Port in Malaysia is 490km, compared to 820km from Bangkok Port. Moreover, transportation time to Penang Port through PBCT was just 3 hours compared to 7 hours to Laem Chabang seaport through the Lat Krabang inland container depot. The government of Thailand encouraged cheaper transport costs either by train or road to avoid heavy competition with PBCT. Furthermore, frequent train services with double tracks, shorter transit times, and the loading time onto wagons were important parameters which provided a strategic advantage to the Lat Krabang inland container depot (UNESCAP 2014; Hanaoka & Regmi 2011). Besides the connectivity and time advantage, dry ports can survive competition by providing differentiated services from other inland terminals. This strategy may attract more clients to dry ports and eliminate competition with other inland terminals.

2.4.4. Location

In general, the location of dry ports are decided by the government sector and invite the private sector to invest in the respective location (UNESCAP 2016). Strategic locations

near seaports, cities or consumption points and borders are important for dry ports (Andersson & Roso 2016). In other words, they may be underutilised owing to the fact that they are not located close to manufacturing areas and consumption points (Visser et al. 2009; Frost 2010; Hanaoka & Regmi 2011). This issue is evident in My Dinh dry port in Vietnam. This dry port faced an overcapacity issue because it was poorly used and was located away from strategic zones (Nguyen 2014). Therefore, My Dinh dry port had to be re-located to the centre of the city to balance trade development and utilise the space.

Shifting some dry ports in Vietnam to the central region of the county will be a significant solution for increasing the balance in regional development and overcoming the overcapacity issue at dry ports. Such attention towards these aspects has inspired more manufacturers and investors to build logistical zones or production areas which have multiplied space consumption in My Dinh dry port (Ngoc et al. 2011). The existence of a dry port next to manufacturers always becomes an advantage for manufacturers and also provides additional benefits to dry ports by improving their utilisation during daily transactions.

For dry ports not at a strategic location, enhancing transport connectivity can be a strategy for overcoming this challenge. In the Netherlands, for example, the location of Drenthe dry port was not on the main East-West transport corridor, and so it had a low volume of throughput to seaports (Visser et al. 2009). Recent upgrading of road infrastructure connecting the East-West corridor reduced the implications of dry port operations for it (Bozuwa et al. 2009).

However, the location of dry ports close to manufacturers also can assist seaports in improving continuity of container volumes. For example, the dry ports Eskilstuna and Jonkoping in Sweden are close to manufacturers and improve the container volume to

Gothenburg seaport (Roso et al. 2009). Other examples are in India, where ICDs were established near industrial zones at Tirupur and Coimbatore and these helped to increase the container volume in Tuticorin and Cochin seaports (Advani et al. 2005). This evidence shows that the location of dry ports close to manufacturers is vital for promoting and facilitating freight distribution in the container seaport system.

Additionally, the location of dry ports close to manufacturers can assist stakeholders in reducing unnecessary costs and time during freight distribution (Haralambides and Gujar 2012). For instance, the fact that Coast 2000 and Halifax dry ports in Canada are located near logistic parks is important for reducing container movements, providing cost and time advantages and reducing congestion in the city (Frost 2010). Consequently, this advantage has increased the attractiveness of dry ports and improved their utilisation.

2.4.5. Others

Other challenges related to dry port operations are labour costs, involvement of manual procedures and lack of involvement of the public sector, which have become an additional concern and have arisen during dry port operations in container seaport systems (Roso et al. 2009; CDP 2013; Nguyen 2014).

2.4.5.1 Expensive labour costs

Professional staff are a key components for dry port operations, and excessive amounts of personnel costs have become a main concern for some dry ports, for example, at Almhult dry port in Sweden (Roso et al. 2009). In order to overcome this issue, a team was formed there as an integrated unit to overcome expensive labour costs. This team combined workforces from different organisations such as seaports, logistic companies, and transport providers to reduce dry port operational costs, since each person was paid by their

respective organisation and not by the dry port. This team achieved high productivity because it consisted of a workforce well-versed in different sectors under one roof (Roso et al. 2009). In this way, dry ports must be creative, innovative and competitive in overcoming challenges for them to serve seaports. This could be a good example of how all components in a container seaport system can cooperate to obtain a collective benefit.

2.4.5.2 Manual procedures in cargo inspection

Dry ports are expected to provide advance facilities and services to dry port users (Qin 2010a). However, there are limitations in fund allocation caused by dry ports unable to provide these services at the required standard and which are still reliant heavily on manual procedures for operations. For example, in Indonesia, the challenges of Cikarang dry port were the time and cost consumed in physical cargo inspections which contributed to high dwelling times in the seaport. To cope with this challenge, the introduction of high-tech clearance facilities were implemented to improve the dwelling times at the dry port, such as initiating an auto-gate system, a fast lane, and integrated cargo systems or 'I-Care'. Initially, the dwelling time at the seaport was 7 days, which was reduced to 4 days after the port emerged in the container seaport system, and it was further reduced to two days after the implementation of high-tech clearance facilities (CDP 2013). In this way the application of high tech facilities for dry port operations can manage to attract more users to the terminals and increase the performance of container seaport systems.

2.4.5.3 Lack of involvement by the public sector

The lack of participation by the public sector can affect the firm regulation of dry port operations (Rodrigue et al. 2006). Dry ports without the influence of the public sector hardly ever receive recognition from manufacturers because of their concern with containers safety and security. For example, in China, Kunming dry port is a border-based

dry port which handles containers from South East Asian countries such as Laos, Myanmar and Vietnam. Kunming city municipality showed insufficient progress in upgrading market regulation and faced issues of insufficient systematic planning and lack of regulation. The participation of the public and private sectors is important in ensuring that dry ports operate effectively with sufficient support financially, and also from a regulatory perspective. According to Beresford et al. (2012), Kunming dry port suffers from limited fund allocations from the central government and this has lead to its poor development in logistic development projects. This has caused the information flow between major players at seaports on the Pearl River Delta to become weak in the supply chain. Limited government influence has reduced the customs authority to interact efficiently and it has become a barrier for market access for the private sector. The lack of systematic planning by incorporating public and private sectors to ensure smooth information transfer has thus become a major disadvantage for dry port development. Table 2.5 summarises challenges faced by dry ports in terms of the discussions above.

Table 2.5: Challenges for dry port development

Challenges	Country	Type of challenges	References
Limitations in transport infrastructure and operation	Sweden	Limited connectivity to and from dry ports	Roso et al. 2009
	Myanmar	Limited connectivity to and from dry ports	Black et al. 2013
	The Netherlands	Low accessibility of freight transportation	Ecorys 2011
	Poland	Difficulties for short distance container delivery	Leszek & Fechner 2012; Fechner 2010
	South Africa	Imbalanced proportion in modal split	Arvis et al. 2010; Kunaka 2013
	Thailand	Imbalanced proportion in modal split	Hanaoka & Regmi 2011
	USA	Congestion in dry ports	Bruce et al. 2013; Roso & Lumsden 2009
Information sharing	Spain	Lack of information integration	Horst & Langen 2008; Dotoli et al. 2010,
	China	Lack of information integration	Beresford et al. 2012
	Belgium	Lack of information integration	FDT 2007; Trainaviciute 2009
	Tanzania	Lack of information integration	Kunaka 2013

Competition	Brazil	Competition with seaports	Ng et al.2013; Cullinane et al. 2012;Robles 2013
	Thailand	Competition with inland terminals	Hanaoka & Regmi 2011; UNESCAP 2014
	China	Competition with seaports	Wang 2009; Feng et al. 2013
Location	Vietnam	Location of dry port away from manufacturers	Nguyen 2014
	The Netherlands	Location of dry port away from transport connectivity	Visser et al. 2009;Rodrigue et al. 2010
Others	Sweden	Expensive labour costs	Roso et al. 2009 ; Bergqvist et al. 2010
	Indonesia	Dependant on manual procedures	CDP 2013
	China	Lack involvement of the public sector	Rodrigue et al. 2006: Beresford et al. 2012

Source: Compiled by the author

These challenges include limitations in transportation infrastructure and operations, issues in information sharing, competition between seaports and other inland terminals, the location of dry ports, labour costs, manual inspections and lack of involvement of the public sector.

2.5 Summary

This overview has indicated that dry ports have emerged to execute the roles and functions of seaports in each of their generations. The development of the Anyport Model and seaport regionalisation have emphasised the need of dry ports to execute seaport functions inland. The seaport lifecycle concept has revealed the need of dry ports to extend a seaport's life cycle without additional capacity enhancement.

The requirement of container seaports to be agile and flexible is difficult to achieve due to their rigidity and complexity. Dry ports as one component in a container seaport system have increased their elasticity during their interaction with their respective hinterlands besides the freight corridor, container seaports and multimodal transportation, and have assisted seaports in adapting to the constantly changing trends in maritime trade activities. The role of dry ports as an extended gateway for container seaports as an integrator for an

intermodal transport system, a freight platform and a promoter of the regional economy has enhanced seaport adaptability by concentrating on their inland requirements.

The trend in challenges to dry ports shows that the limitations in transportation infrastructure and operations, issues in information sharing, competition, location and other issues are some of the significant challenges faced by dry ports. The following chapter reviews factors that influence dry port operations and their impacts on container seaport competitiveness.

CHAPTER THREE

DRY PORT OPERATIONS

AND CONTAINER SEAPORT

COMPETITIVENESS

3.1 Introduction

This chapter reviews the literature concerning factors that influence the effectiveness of dry port operations. It further discusses how dry ports can assist in seaport operations to enhance seaport competitiveness.

3.2 Influencing factors on dry port operations

The influencing factors of dry port operations discussed in this section are derived from existing literature concerning the worldwide experience of dry port operations. Table 3.1 shows factors for dry port operations often referred to in the existing literature. The following sections discuss these factors which affect dry port operations. The sub factors for each factor were chosen based on balanced coverage with the main factors (Osborne et al. 2013).

Table 3.1: Influencing factors for dry port operations

Influencing factors	Sub-factors	Literature
Hinterland conditions	Location	Jarzemkis & Vasiliakas (2007); Bergqvist et al. (2010); Hanaoka & Regmi (2011); Padilha & Ng (2012); Chang et al. (2015),
	Transport connectivity	Roso (2008); Horst & Langen (2008); (Ahamed 2010), Bergqvist et al. (2010); FDT (2007); Hanaoka & Regmi (2011);
	The freight market	UNCTAD (1991); Ng et al. (2013); CDP (2013); Black et al (2013); Woxenius & Bergqvist (2011); Hanaoka & Regmi (2011)
	The seaport / dry port relationship	Rosa & Roscelli (2009); Ng et al. (2013)
Services features	Customs clearance	Panayides & Song (2009); Roso & Lumsden (2010)
	Container storage, maintenance and transfer	Beresford & Dubey (1990); Roso & Lumsden (2010); Ng & Cetin (2012); Aversa et al. (2005); Nguyen (2014)
	Value-adding services	Padilha & Ng (2012); Robles (2013); Andersson & Roso (2016)
Government policy	Investment Policy	Rodrigue et al. (2006); FDT (2007)
	Cabotage Policy	Garnwa et al. (2009); San Antonio Port (2014); Brooks et al. (2014)
	Multimodal Transport Policy	Mussone et al. (2015); Curtis (2009); Hanaoka & Regmi (2011)
	Seaport Policy	Mak & Tai (2010); Sukdanot (2013); Nguyen (2014); Black et al. (2013)
	Transport Infrastructure Policy	Shirley & Winston (2004); Doust & Black (2009); Ng & Gujar (2009); Ng & Cetin (2012); Garnwa et al. (2009)

Capacity	Facilities and transport infrastructure	UNESCAP (2010); Jarzemskis & Vailiauskas (2007); Hanaoka & Regmi (2011); Dotoli et al. (2010); UNESCAP (2010); Roso (2008); Andersson and Roso (2016)
	Space	UNESCAP (2010); Andersson and Roso (2016); Woxenius et al. (2004); Bruce et al. (2013); Frost (2010); Black et al. (2013)
Information sharing	Information collaboration	Bichou & Gray (2004); Panayides & Song (2009); Horst & Langen (2008)
	Coordination	Horst & Langen (2008); Dotoli et al. (2010)

3.2.1 Hinterland conditions

Research such as Jarzemskis and Vailiauskas (2007); Padilha and Ng (2012) and Ng et al. (2013) indicates that the location of a dry port, its transport connectivity, the freight market supporting its operations, and its relationship with seaports are the main determinants for functional dry port operations. These determinants are categorised as hinterland condition factors.

3.2.1.1 Location of the dry port

The location of dry ports in relation to seaports and industrial zones affects how they can support the capacity of seaports in accommodating container traffic and helping shippers to reduce their transportation costs (Jarzemskis & Vailiauskas 2007; Bergqvist et al. 2010). The costs of development and economic stimulus for regional economic development are the major factors affecting the determination of dry ports. These two elements provide a high potential for industrial development and generate a demand for dry ports (Bergqvist et al. 2010; Hanaoka and Regmi 2011; Chang et al. 2015). For example, in Sweden, dry ports are located adjacent to industrial development zones to assist the shipper in maximising their profits by reducing the cost of transportation from the hinterland to seaports (Bergqvist et al. 2010). This example indicates that the location of dry ports near manufacturing areas promotes the development of a dry port by providing costs and time advantages to shippers.

On the other hand, a well-positioned dry port directly connected to a seaport attracts service providers and manufacturers to their surrounding area and supports the seaport in expanding its hinterland markets. For example, in the USA, Virginia Inland Port is a seaport based dry port supporting the Port of Virginia. This dry port has managed to attract capital investment from private investors and this has prompted the establishment of new firms near the dry port (Padilha & Ng 2012). This example demonstrates that a dry port itself can attract businesses and investment as long as it is in a good location with a good connection to a seaport.

3.2.1.2 Transportation connectivity

As an important node in the transport network, dry ports must possess a high frequency of transport services (Roso 2008) and a high quality of transport infrastructure such as rail, road or inland waterways (Horst & Langen 2008) for container distribution to and from the seaport. Transport efficiency and a high capacity of transport modes increase the speed of movement of containers without excessive dwelling times, which subsequently minimises overall transport costs (Ahamed 2010). The ability of a dry port to provide sufficient transport services due to the adequate transport connectivity prevents clients from outsourcing to external logistic providers (Bergqvist et al. 2010). An outcome from research on networking development between logistic centres, seaports and other logistic operators by The Association of Danish Transport Centres (FDT) indicated that for effective dry port operations, regularity, frequency, dependability, flexibility and availability of transport connections between seaports and dry ports are critical from the carriers' perspective (FDT 2007).

For example, according to Hanaoka and Regmi (2011), the combination of road and rail transportation to and from seaports via dry ports for container collection and distribution

increases the traffic of containers being handled in Indian inland container depots (ICD). In Africa, however, poor connections of land transport systems have increased container dwelling times from 12 to 15 days, well exceeding the international best practice time of seven days. This kind of slow movement of containers due to poor transport connectivity is the main reason for the failure of the dry port in Egypt (Government of Egypt 1999). These examples show the importance of a high level of transport connectivity between dry ports and to seaports because they affect the performance of dry ports and the efficiency of the container transportation system.

3.2.1.3 The freight market

The availability of the freight market from the production zone all the way to a seaport via a dry port also supports dry port operations. The volume of containerised commodities, directional split for imports and exports and forecasts of future growth in trade flows are vital for dry port operations (UNCTAD 1991). In Brazil for example, space limitations make it unable to gain further benefits from the economics of scale, in fact they have increased the inconsistency of freight flows to and from the Santos seaport. However, the involvement of dry ports in Sao Paulo has increased the concentration of minerals and agricultural freight flows at Santos seaport (Ng et al. 2013). The development of Mandalay Dry Port in Myanmar and Cikarang Dry Port in Indonesia are examples of some dry ports assisting seaports to enhance their container volume in their respective regions (CDP 2013; Black et al 2013). These examples show that the availability of a freight market contributes to a positive outcome in dry port operations and contributes to additional containers to seaports.

Low availability of freight in Amal Dry Port in Sweden caused this dry port to be urgently shifted to another place close to the production area. The shifting of Amal Dry Port to a

manufacturing area increased the volume of containers and utilised the space and capacity of the dry port (Woxenius & Bergqvist 2010). The establishment of dry ports close to manufacturing areas not only secures freight to dry ports but also reduces transportation costs and prevents delays for manufacturers in distributing containers to seaports through their respective dry ports (Hanaoka & Regmi 2011).

3.2.1.4 The seaport–dry port relationship

Although it is noted that the association between seaports and dry ports is important for the two transport nodes to work efficiently in a freight system (Rosa & Roscelli 2009), in reality competition exists between seaports and dry ports, limiting the performance of dry ports. Particularly when a seaport shows a high interest in dominating its hinterland markets, it triggers competition with dry ports. This has been evident in dry ports in Brazil (Ng et al. 2013).

Competition in similar functions between seaports and dry ports affects the performance of dry ports. For example, seaports intend to gain benefits from dwelling time by delaying the container transfer from seaports to dry ports. As a result, the dry port operator is unable to operate at a competitive advantage level and can fail to deliver containers to the shipper at the promised time (Ng et al. 2013). This implies that a collaborative relationship between dry ports and seaports should be formed to enhance dry ports in managing container freights smoothly, which will in turn benefit customers.

3.2.2 Services features

Research such as that conducted by Roso and Lumsden (2009; 2010), and Ng and Cetin (2012) indicated that the provision of services provided by dry ports including customs clearance, container storage, maintenance and transfer between modes, and value-adding

activities, influence their attractiveness to users. The following section explains how each service feature component can influence dry port operations.

3.2.2.1 Customs clearance

Customs clearance is the most important service expected from dry ports. The implementation of customs clearance beyond seaport territory reduces container waiting times and congestion in the seaport area (Panayides & Song 2009). Customs clearance procedures in dry ports makes the containers available for direct shipment (export) and also direct distribution to the dry port after shipment (import). This procedure reduces container transit times in the seaport which significantly reduces congestion, cost, and provides a time advantage to the clients as well (Roso & Lumsden 2010).

3.2.2.2 Container storage, maintenance and transfer

Warehouses, container maintenance workshops and depots for empty containers are prerequisites for dry port operations (Roso & Lumsden 2010; Ng & Cetin 2012). The availability of a full range of services in a dry port promotes the dry port concept of ‘Through-Transport,’ that is, of dry ports as common user facilities supporting transfer of containers from the seaport of origin to the seaport of destination (Beresford & Dubey 1990). For example, some dry ports such as the Los Andes dry port in Chile and Vietnamese dry ports took their own initiative to buy trucks and offer haulier services especially for short-distance clients because of the lack of hauliers showing interest in providing delivery services for short-distance customers (Aversa et al. 2005; Nguyen 2014).

In Tanzania, the Isaka Dry Port provides a crossborder transportation service and documentation clearance for landlocked countries, which decreases their transportation

costs, enhances the speed of container delivery and reduces congestion and delays in the Dar er Salaam seaport (Arvis et al. 2010). In summary, dry ports have to be equipped with sufficient capacity, transportation facilities and professional labourers to deliver container storage, maintenance and transfer services to their users without depending on external service providers.

3.2.2.3 Value-adding services

In addition to offering services such as loading/unloading, storage, maintenance, transfer, administration, customs and warehousing, dry ports are expected to provide a range of value-adding services, for example sorting, mixing, blending, making, barcoding, packing, and labelling. These services develop an advantage to attract customers, and compete with seaports and other types of inland terminals (Robles 2013). As evidence, in the dry ports in Brazil, the introduction of parameterisation in container clearance and a range of value-adding services has increased the productivity of the Brazilian dry ports and reduced their competition with seaports (Robles 2013).

Providing a range of value adding services on time with reliable quality increases dry port attractiveness. Moreover, it can potentially increase a dry port's cargo handling volume, enhance customer satisfaction, and establish a good relationship with the players in the transport chain (Andersson & Roso 2016). Incompetence in providing a range of value adding services is the main reason for the closure of Piracicaba Dry Port in Brazil (Padilha & Ng 2012). Hence, the ability of dry ports to provide value adding services increases their utilisation and their ability to compete with seaports and other inland terminals. However, not all dry ports are expected to provide value added services. For example, border based dry ports are expected to provide customs clearance rather than value added services

(Woxenius and Bergqvist 2010). This indicates that the location of the dry port has become one of the factor that determine dry port services.

3.2.3 Government policy

Government policies on transport infrastructure development and management are relevant to dry port operations. These policies include infrastructure investment (Shirley & Winston 2004), cabotage (Garnwa et al. 2009), multimodal transport (Horst et al. 2011) and seaport and transport infrastructure (Mak & Tai, 2010). How each policy affects dry port operations is discussed in the following section.

3.2.3.1 Investment policy

Investment policy which allows an agglomeration between private and public partnerships (PPP) in dry port operations has been widely adopted, involving the private sector in financing dry port development, while the public sector provides land for development and plays a regulatory role in their operations (Rodrigue et al. 2006). Therefore, PPP is the combination of both sectors, and increases efficiency by providing legal, technical and financial competence between both parties to manage and operate dry ports (Rodrigue et al. 2006; FDT 2007). This policy also increases transparency, and information sharing, it tightens security in dry ports and strengthens experience and knowledge for the smooth operation of the dry ports (FDT 2007).

3.2.3.2 Cabotage policy

Cabotage policy is the trade between respective seaports within a region by vessels registered in their countries, known as national flag vessels. This policy is important for encouraging costal shipping by enhancing the population of local registered vessels and

increasing the incorporation of local companies in domestic shipping (Suffian et al. 2013). As a result, dry ports may benefit from the increase in coastal shipping activities. For example, the introduction of a cabotage policy by the Nigerian Government increased coastal shipping activities and subsequently enhanced the utilisation of dry ports which reduced ship, train and container turnaround times, prevented excessive charges and promised continuity of container volume to seaports (Garnwa et al. 2009). In Chile, cabotage policy has increased the volume of containers to San Antonio seaport through Los Andes dry port by almost 50% (San Antonio Port 2014).

Development in short sea shipping through cabotage policy develops high collaboration in intermodal operations. Cabotage policy integrates the trucking and rail industries effectively and efficiently (Brooks et al. 2014). Therefore, seeking inland distribution to reduce the transport costs of reaching final destinations becomes the ultimate target of this policy.

3.2.3.3 Multimodal transport policy

Dry ports perform the role of integrating different modes of transport, therefore a multimodal transport policy which affects modal split is important for dry port operations. By utilising rail transport, for example, traffic congestion is alleviated, emissions are lowered, and distribution costs and time are reduced (Mussone et al. 2015). In South Africa, an imbalanced proportion of rail and road transportation modes (30:70) caused delays, congestion and difficulties in predicting vessel turnaround times (Curtis 2009). Thus, policy makers had to pay a great deal of attention to initiating, promoting and implementing a multimodal transport policy which focused on transport links and transport

nodes for the efficient delivery of containers from origin to destination (Hanaoka & Regmi 2011).

3.2.3.4 Seaport policy

Seaport policy which aims at utilising and improving landside transportation and establishing inland networks impacts on dry port operations. This kind of policy has been developed parallel to the seaport industry especially in terminal specialisation and the demand for effective inland transportation systems (Mak & Tai 2010). The implementations of seaport policy in Thailand, Myanmar and Vietnam have generated additional investment into the development of transportation links connecting these seaports, dry ports and their respective hinterlands. This approach has improved intermodal infrastructure and seaport-hinterland connectivity (Sukdanot 2013; Black et al. 2013; Nguyen 2014).

3.2.3.5 Transport infrastructure policy

Transport infrastructure policy provides capacity and durability in the form of highways, railway gauges, traffic lanes and thick pavements for heavy motor vehicles to achieve effective distribution processes (Shirley & Winston 2004). The development of transportation infrastructure attracts investments in that particular location. By the emergence of new manufacturers, dry ports secure freight to and from seaports. For example, in Mandalay dry port in Myanmar, the government has reduced land costs and tax rates to encourage the development of new industries near Mandalay dry port. This support from the government has attracted new industries to operate adjacent to the dry port, creating new job opportunities and boosting regional development in Myanmar (Doust & Black 2009).

This kind of government influence can determine dry port performance and also can boost regional development (Ng & Gujar 2009). Consequently, the implementation of centralised integrated planning, clarity in regulations for initiating infrastructure investment and developing new legislation to encourage collaboration between seaports and dry ports can generate effective use of inland logistic infrastructure for economic and environmental benefits (Garnwa et al. 2009; Ng & Gujar 2009; Ng & Cetin 2012).

3.2.4 Capacity

Facilities, transport infrastructure and space are major factors determining dry port capacity and affect their operations (Jarzemskis & Vailiauskas 2007; Black et al. 2013). These elements allow dry ports to perform logistic, transport, administrative and value adding functions for their clients and help them support seaports in coping with the dynamic environment that they are in.

3.2.4.1 Facilities and transport infrastructure

Dry ports should have sufficient facilities to ensure efficient transloading activities. According to UNESCAP (2010), a tractor-trailer system, a lift-truck system, a rubber-tired gantry crane system and a rail-mounted gantry crane system are the basic forms of equipment needed in dry port operations for container handling activities. Most customers are attracted by the high standard and sophisticated equipment used at dry ports for handling their valuable containers and reduces the risk of container damage, and consequently lead to on time shipment (Jarzemskis & Vailiauskas 2007).

In addition, for increasing operational efficiency, modernised facilities should be invested in dry ports (Hanaoka & Regmi 2011). For example, the implementation of a Port

Community System (PCS) in Valencia dry port in Spain integrated different stakeholders into the seaport operations and maritime transport by giving support, managing information exchange and administrative procedures in the dry port operations (Dotoli et al. 2010). Further, modernised facilities, implemented information and communication technology for container tracking facilitated the freight task between Delhi-Mumbai-Kolkatta and have improved container volume from 1.5 million TEUs in 2000 to 2.2 million TEUs in 2010 at Dadri ICD in India (UNESCAP 2010).

Road infrastructure such as highways and paved roads for high accessibility to the seaport via the dry port are essential. Rail infrastructure such as rail platforms, rail sidings and sufficient and well-maintained railway tracks are necessary for effective dry port operations (Roso 2008). According to Andersson and Roso (2016), the inclusion of a well-developed rail and road infrastructure with value adding services at dry ports greatly improved their performance and attracted users.

3.2.4.2 Space

Dry ports are expected to be developed with adequate space so that they can allow efficient, reliable and economical movement of containers. The space in dry ports is determined by reasonable forecasts of anticipated volumes of containers. Usually, dry ports should have provision for future expansion (UNESCAP 2010). Space capacity at dry ports can assist in solving space restrictions at seaports so as to reduce seaport congestion, promote economic development and enhance logistic integration at the seaport (Andersson and Roso 2016).

The main issue that seaports face as a result of containerisation is the lack of space at the seaport terminal and growing congestion on the access routes serving the terminals (Woxenius et al. 2004). Examples are evident at the Virginia inland port that complements

the Virginia seaport in the USA, at the Halifax dry port for Vancouver seaport in Canada, and at the Myanmar dry port for Yangon seaport (Bruce et al. 2013; Frost 2010; Black et al. 2013). Additional capacity at a dry port to support seaport operations can help reduce capacity constraints at nearby seaports and simultaneously develop a healthy cooperation between these two entities.

3.2.5 Information sharing

Dry ports need to be able to possess sufficient and accurate information from other players within the container freight system for moving container freight efficiently and effectively. Therefore, dry ports involved in information collaboration and coordination with other actors in the container seaport system are necessary. Information collaboration and coordination with relevant stakeholders help dry ports especially in risk sharing, asset utilisation, accurate forecasting and decision making both vertically and horizontally (Christiaanse & Kumar 2000).

3.2.5.1 Information collaboration

Some research conducted by Bichou and Gray (2004) on seaport performance measurements carried out through a logistic and supply chain management approach revealed that almost 85% of seaports showed interest in collaborating with other intermodal terminals especially in information sharing. They believe that information sharing through EDI can develop an advanced partnership between the logistic channel partners, and that it can benefit all players in the network.

Panayides and Song (2009) argue that information sharing between seaports, dry ports and other stakeholders leads to a high level of integration in the supply chain, and improve reliability, dependability and speed. In addition to this argument, information sharing

through a Port Community System (PCS) between players can also reduce total distribution costs and increase efficiency in supply chain performance (Bichou & Gray 2004). A PCS is an electronic network enabling an intelligent and secure exchange of information between seaports, dry ports, freight forwarders, shippers, shipping lines, rail operators, hauliers, government bodies and other related stakeholders in a single network to execute efficiency in a supply chain (Horst & Langen 2008). The linkage between all components and various players in container seaport systems ensures that the coordination and collaboration between them is reliable for effective container transportation from one point to another in the container transportation chain.

3.2.5.2 Coordination

Coordination is a set of methods used to manage interdependence between organisations with each organisation dependent on the performance of other organisations in the chain (Horst & Langen 2008). Coordination from the entire seaport community including from dry ports, is necessary for enhancing the efficiency of dry port operations (Horst & Langen 2008). Valencia dry port faced many issues in regard to an inconsistency of information from stakeholders, and a lack of standardised procedures, as well as misinterpretation over the roles of various stakeholders. By adopting the PCS, which integrated different stakeholders into a single administration, the above mentioned issues were overcome (Dotoli et al. 2010).

3.3 Dry ports and seaport competitiveness

This section discloses the relationship between dry ports and container seaport competitiveness. It aims to discuss how dry port operations contribute to container seaport competitiveness. After synthesising a range of criteria for measuring seaport competitiveness from the literature, it discusses the possible impacts of dry ports on

container seaport competitiveness measured by five factors including seaport performance, seaport capacity, seaport-hinterland distance, seaport services and trade.

3.3.1 Seaport competitiveness

Bichou and Gray (2005) indicated that the criteria for a seaport competitiveness measurement varies from time to time because of the significant impact of institutional functions, seaport competition, spatial development, channel management, improvement of seaport services and changes in the business environment. Therefore, the measurement of seaport competitiveness is complex due to the fact that perspectives of relevant users in choosing a seaport can be so wide and varied (Mileski et al. 2014). However, seaport competitiveness is determined by the effective and efficient offering to shippers and shipping lines of specific trade routes, geographical regions and access to other seaports.

The competitiveness of seaports is determined by a range of competitive advantages that are required or created by the seaports (Haezendonck & Notteboom 2002). Some of the standpoints are that container seaports are likely to be more competitive if they:

- Possess excellent hinterland access
- Offer superior connectivity to the market
- Receive consistent support from key stakeholders in the seaport area
- Involve the private sector in terminal operations
- Provide sufficient space for future development and capacity extensions
- Be involved in providing logistic services to facilitate freight (Notteboom & Yap 2011).

The focus of seaport competitiveness has evolved over time. Table 3.2 presents the focus of seaport competitiveness in the past decades (1980-2016). The scope of seaport competitiveness has varied over the years because of the core objectives that they have,

and it has changed considerably during this time as a result of changes in the environment in which seaports have operated.

Table 3.2: Focus of seaport competitiveness (1980-2016)

Period of time	Competitiveness	References
1980-1990	Seaport reliability	Pearson 1980
	Seaport costs	Willingale 1981
	Seaport facilities	Murphy et al. 1988; 1989
	Seaport equipment	Slack 1985; Brooks 1984, 1985
	Seaport services	Collision 1984; Peters 1990
1991-2000	Location	Starr 1994; Storper 1997
	Information	Murphy et al. 1991; 1992; UNCTAD 1992
	Distance between origin and destination	Kim 1993
	Seaport productivity	Jeon et al. 1993
	Inland transportation	McCalla 1994
	Documentation procedure	Chiu 2000
	Seaport labour	Starr 1994
	Rapidness	Tengku 1995; Chiu 2000
2001-2010	Seaport operations and inland freight distribution	Notteboom & Rodrigue 2005
	IT application	Wong et al. 2009
	Value-adding services	Song & Yeo 2004; Song & Panayides 2008; Wiegmans et al. 2008
	Value-adding logistic services	Haезendonck et al. 2001; Malchow & Kanafani 2001; Yeo et al. 2008
	Free Trade Zone	Bichou & Gray 2005
	Operational efficiency	Rodrigue 2004; Notteboom & Rodrigue 2006
	Reliability	Song & Panayides 2008
	Government and economic policy	Yeo et al. 2008
	Safety and security	Bichou 2004
	Accessibility to the hinterland and high geographical scope of freight distribution	Sanchez & Wilmsmeier 2010
2011-2016	Inland transit time	Haralambides et al. 2011
	Corridor capacity	Fraser & Notteboom 2012
	Inland infrastructure	Douglas et al. 2014
	Seaport hinterland and intermodal transportation	Migliardi et al. 2013
	Hinterland cargo demand	Yang et al. 2014
	Cost of inland transportation	Yang et al. 2014
	Seaport dwelling time	Mueller et al. 2014
	Hinterland costs	Mueller et al. 2014
	Rail services	Mueller et al. 2014
	Inland waterway services	Mueller et al. 2014
	Availability of transport corridors	Debelic et al. 2016

From 1980 to 1990, seaport activities were mainly shifting goods between land and sea. Therefore, seaport competitiveness mainly focused on their operational side, which consisted of reliability, cost, facilities, equipment as well as seaport services.

Between 1991 and 2000, the impact of globalisation and trade development has led seaports to extend their service connections inland. Seaports engaged in developing information sharing networks, enhancing productivity and rapidness, and inland transportation. In this way, the focus of seaport competitiveness changed towards location, information, distance between origin and destination, seaport productivity, inland transportation, documentation, seaport labour and rapidness.

Furthermore, during the period of 2001- 2010, seaport operations have been affected by advancement in supply chains. These have increased the pressure on seaport operations and inland freight distribution. Seaports have been engaged in providing more logistic activities such as freight distribution and value-adding logistic services. Therefore, the focus of seaport competitiveness has been focused on IT application, value-adding services, value-adding logistic services, Free Trade Zones, operational efficiency, reliability, government and economic policy, and safety and security. Changes in the scope of competitiveness show a high engagement of the economic system within the seaport hinterland with a broad international trade perspective facilitated by a high level of accessibility to the hinterland and a high geographical scope of freight distribution.

From 2011 until 2016, the concentration of determinants in seaport competitiveness has focused on inland transit times, corridor capacity, inland infrastructure, port hinterland and intermodal transportation, hinterland cargo demands, the cost of inland transportation, seaport dwelling time, hinterland costs, rail services, inland waterway services and the availability of transport corridors.

From 1980 to 2016, the characteristics of seaport competitiveness have evolved and more focus has come onto hinterland connections or networks, external logistic assistance, simplification of documentation, and interlinked transport networks. According to Rodrigue and Notteboom (2010), the expansion of the seaport hinterland through regionalisation has developed a strategic link close to inland freight distribution centres. This strategic development has been required to adapt to the imperative distribution system and dynamic global production network. A dry port thus has been developed as a connecting node with different players to simplify container traffic in the supply chain and increase the competitiveness of seaports (Heaver 2001; Notteboom & Winkelmanns 2001).

3.3.2 The impact of dry ports on seaport competitiveness

This section aims to discuss how dry ports affect seaport competitiveness based on a review of the existing literature. It discusses how dry ports assist container seaports in achieving or maintaining a high level of competitiveness from the perspective of five seaport competitiveness measures: seaport performance, seaport capacity, seaport-hinterland distance, seaport services and seaport trade (see Table 3.3).

Table 3.3 Seaport competitiveness influenced by dry ports

Seaport Competitiveness	Components influenced by dry ports	Literature
Enhancement in seaport performance	Ship calling frequency	Langen & Lugt (2007); Roso (2008)
	Reliability	Heaver (2001); Ballis & Golias (2002); Roso et al. (2009);Notteboom (2006);Roso (2008);Rodrigue & Notteboom (2009); Beresford et al. (2012).
	Efficiency	Roso et al. (2009); Bichou & Gray (2005);Cetin & Cerit (2010); Roso (2008); Rodrigue & Notteboom (2009); Jarzemskis & Vailiauskas (2007); Ng & Gujar (2009)
	Cost	Roso & Lumsden (2010);Rodrigue and Notteboom (2010)
	Berth productivity	Roso (2008);Roso et al. (2009);Padilha & Ng (2012)
Enhancement in seaport capacity	Additional space for seaports	Roso (2008);Frost (2010)
	Additional facilities to seaports	Visser et al. (2009); Roso & Lumsden (2010); UNESCAP (2010);Haralambides & Gujar (2011);Bichou & Gray (2004); Frost (2010)
Improvement in seaport-hinterland proximity	Hinterland transport networks	Jarzemskis & Vailiauskas (2007); Migliardi et al. (2013); Roso & Lumsden (2010)
	Hinterland extension	Ng & Cetin (2012);Roso et al. (2009);Roso et al. (2015);Roso et al. (2009); Woxenius et al. (2004);Rodrigue (2006); McCalla (2007); Rodrigue & Notteboom (2010)
	Hinterland accessibility	Tongzon (2009);Roso (2008);Crainic et al. (2015)
	Hinterland connectivity	Notteboom & Rodrigue (2005);Ng & Gujar (2009);Wisetjindawat et al. (2007);
Increase in service variations for seaports	Supplementary services for seaports	Roso & Lumsden (2010); UNESCAP & KMI (2007); Roso et al. (2009);Crujssen et al. (2007);Andersson & Roso (2016);Notteboom and Rodrigue (2009)
	Flexibility	Paixao & Marlow (2003);Varhoeven (2010);FDT (2007);Notteboom & Winkelmans (2001); Notteboom & Rodrigue (2005);Cetin & Cerit (2010)
Increase in seaport trade volume	Continuity in container flow	Allen (2007); Ng & Gujar (2009); Roso & Lumsden (2010); Notteboom (2006) Werikhe & Jin (2015)
	Transshipment containers	Lirn et al. (2004); Rodrigue & Notteboom (2009);Roso & Lumsden (2010); Ng & Cetin (2012);Notteboom (2006);Acciaro & McKinnon (2013);Rodrigue and Notteboom (2012);Beresford et al. (2012);Henttu and Multaharju (2011)

3.3.2.1 Enhancement in seaport performance

The involvement of dry ports in the container seaport system has affected the performance of container seaports by enhancing ship calling frequency (Langen & Lugt 2007), seaport

reliability (Heaver 2001; Ballis & Golias 2002) and seaport efficiency (Bichou & Gray 2005; Roso 2008; Ng & Gujar 2009), cost reduction (Roso & Lumsden 2010), and improving berth productivity (Beresford et al. 2012). The following section elaborates on how these dry ports capitalise on these components and increase seaport performance.

3.3.2.1.1 Ship calling frequency

A high frequency of ship calls leads to a high volume of containers in seaports. Ship call frequency requires seaports to provide an effective transport network to transport inbound containers quickly. Seaports utilising a dry port can reduce the congestion in seaports and ease the container flow to them (Roso 2008). In addition, the option of multitransportation for faster container transportation may decrease transportation costs. Therefore, high flexibility and lower container transit time and dwelling times help to attract more vessels calling in at the seaport (Langen & Lugt 2007).

3.3.2.1.2 Reliability

Reliability in seaports refers to the degree of stability and quality of services that are offered by them (Ballis & Golias 2002). Seaport users expect seaports to have a good reputation, 365 day a year operations, fast responses to logistic demands, and good relationships with shipping lines and inland transport operators (Roso et al. 2009). The seaport user or shipping line expects a high reliability of services because of their intention to reduce turnaround time which obviously reflects on cost factors (Notteboom 2006).

Including a dry port in the container seaport system can enhance the reliability of the seaport because the connection of this intermodal terminal with a seaport reduces traffic congestion and the costs of container distribution along with the capacity restrictions of the seaport, and it provides a highly secure container distribution system for it (Roso 2008).

Operating in the complex global transport network means that seaports must ensure all links that connect the hinterland through dry ports do not fail to function, and if they do, that might cause unreliability in the network and subsequently affect the serviceability of seaports (Notteboom 2006).

Dry ports which control freight transportation through various modes of transportation manage the container flow to and from seaports effectively and overcome decreasing confidence in shipping schedules by providing effective connectivity for on time container flow. This consequently leads to higher service frequency, lowers freight costs through modal split and results in schedule integrity at the seaport (Rodrigue & Notteboom 2009; Beresford et al. 2012). The emergence of dry ports in container seaport systems therefore has shown evidence that it improves seaport reliability in serving various clients from the foreland to the inland.

3.3.2.1.3 Efficiency

The results of globalisation and the development of supply chain and logistic systems influences a seaport operations by increasing congestion, increasing transport maintenance costs and decelerating freight distribution, all of which have a significant impact on seaport efficiency and competitiveness (Roso et al. 2009; Rodrigue & Notteboom 2009). Efficiency refers to the ability to utilise minimum input of resources in responding to demand, process or structure with high flexibility, adaptability, productivity and satisfaction of the clients in the system (Cetin & Cerit 2010). The emergence of dry ports in the seaport system provides the following benefits in enhancing their efficiency (Bichou & Gray 2005; Jarzemskis & Vailiauskas 2007; Ng & Gujar 2009).

- Reducing waiting time at seaports
- Offering convenient pick-up and delivery times
- Reducing detention hours at seaports
- Providing an efficient transportation system
- Increasing rapidness in operations
- Improving efficiency for inland transport networks
- Lowering seaport dwelling times
- Increasing the speed of inland transit times
- Freeing up dwelling time at the terminal
- Increasing efficiency of terminal-land interface handling
- Increasing seaport productivity and operation quality

The above benefits are derived from dry port implementation of functions discussed in Chapter Two, i.e. transportation, logistic, value-adding services and administration functions. They provide additional strength for dry ports to deliver cost and service efficiency in the logistic supply chain and they subsequently enhance the seaport's reputation among its stakeholders (Ng & Gujar 2009).

3.3.2.1.4 Costs

Roso and Lumsden (2010) reveal that the implementation of a dry port has a significant impact on inland transportation costs and cargo handling costs, as well as transfer and storage costs. As indicated in Figure 3.1, container fragmentation and various transportation options in dry ports reduce the pressure of seaports in handling massive volumes of containers and they reduce transportation costs accordingly (Rodrigue and Notteboom 2010). The figure shows that utilising the capacity of dry ports is able to help

handle massive volumes of containers and provide an economy of scale for their respective clients, as well as reducing transportation costs accordingly.

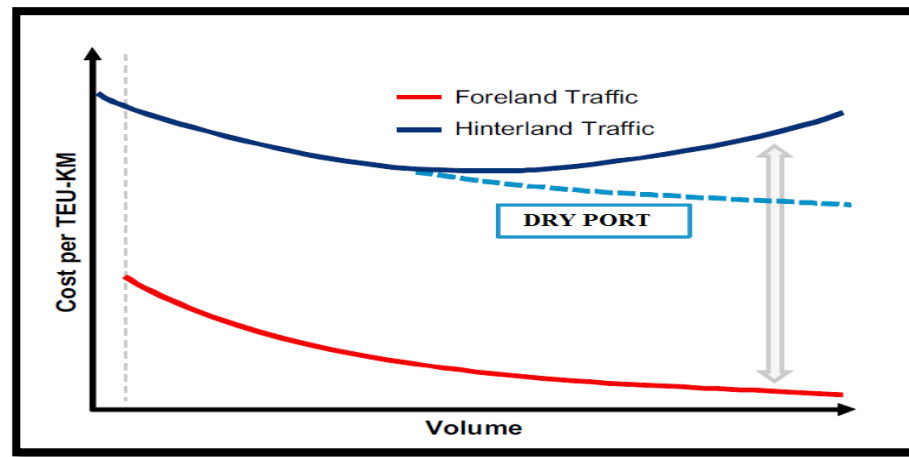


Figure 3.1: Effects of dry ports on the cost of hinterland traffic
Source: Adapted from Rodrigue and Notteboom (2010)

3.3.2.1.5 Berth productivity

Roso (2008) argues that seaport access to a dry port affects the quality of berth performance. The availability of berths for vessels depends on fast, efficient and reliable intermodal links between the seaport and the clients through dry port facilities (Roso et al. 2009). Modal availability to and from dry ports increases the speed of container movements to and from a seaport's yard. Dry ports increase the turn-around of the fleet at seaports and subsequently consistently provide space for incoming vessels (Padilha & Ng 2012). Hence, the participation of dry ports assists seaports in enabling faster operations, and they provide substantial benefits to the clients from the foreland.

3.3.2.2 Enhancement in seaport capacity

Dry ports, providing space and facilities to undertake some seaport functions inland, are able to improve a seaport's capacity by easing congestion and constraints on further expansion (Roso 2008; Tongzon 2009). Consequently, seaports gain additional space and facilities for their operations through them.

3.3.2.2.1 Additional space for seaports

Rising numbers of container flows in any seaport results in congestion at its terminals, which significantly increase the container dwelling times and finally cause delays (Ng & Gujar 2009; Roso & Lumsden 2010). Utilising dry ports to undertake logistic functions and to provide customs clearance and other value adding services helps seaports ease their space constraints (Roso 2008). In New Zealand, Wiri Inland Port helped to manage delayed containers transferred from the seaport; this also reduced the demurrage charges at the seaport (Frost 2010). Therefore, space capacity provided by dry ports manages to increase clients approaching this entity with minimum implications on cost and time. It also allows seaports to have additional space for operations.

3.3.2.2.2 Additional facilities to seaports

Seaport facilities refer to the investment in a seaport and its extended seaport capabilities (Visser et al. 2009). Investment in seaport facilities allows faster and safer container distribution and at the same time it assists ships at seaports to achieve economies of scale (Roso & Lumsden 2010; UNESCAP 2010). However, not all seaports manage to secure fund allocation for facility development. Therefore, the existence of dry ports with sufficient facilities can manage to assist seaports in easing container distribution, documentation clearance, value adding services and container management effectively beyond the seaport perimeter (Veenstra et al. 2012b).

In Brazil, some seaports are operated based on a road bias policy and give less priority to rail freight. Anapolis dry port provides sufficient rail freight facilities to transport almost 87% of containers headed to seaports from the hinterland (Ng et al. 2013). Besides rail facilities, refrigerated facilities in this dry port have enhanced consolidation of agriculture

products and improved the volume of perishable goods going to seaports in Brazil. This indicates that the ability of dry ports to provide both types of freight including road and rail can improve the continuity of container volume to and from seaports and prevent them from over utilising a single mode of freight transportation in the container seaport system.

Dry ports allow the operator to design their own facilities based on their own specifications and business requirements in a short time period. For example, a back door facility provided by Canada's Halifax dry port allowed container movements without access to the public road (Frost 2010). The introduction of an X-ray scanner and explosive detection equipment are additional facilities that dry ports may provide to the seaport to ensure container security (Haralambides & Gujar 2011). However, these kinds of facilities are rarely provided by seaports due to restrictions in time, space, policies, financial support and rigidity in operations (Bichou & Gray 2004; Haralambides & Gujar 2011). Therefore, the ability of dry ports to provide additional facilities to support seaport operations can greatly improve the compatibility of seaports and dry ports.

3.3.2.3 Improvement in seaport-hinterland proximity

The emergence of dry ports as an extension of seaports can help improve the proximity of seaports to their hinterlands through offering transport networks (Jarzemskis and Vailiauskas 2007), enhancing accessibility to seaports and hinterlands (Klink 2000), and increasing a seaport's connectivity (Ng & Gujar 2009; Ng & Cetin 2012). The following sections discuss these three impacts of dry port operations, which assist seaports to expand their hinterlands.

3.3.2.3.1 Hinterland transport networks

An inland transport network including dry ports reduces seaport traffic congestion, enhances inland transshipment between various modes of transportation and provides logistic sequencing services to satisfy seaport clients (Migliardi et al. 2013). Further, an integrated transport network through dry ports offers the shortest route for container transport and transfer activities in the network which subsequently can reduce transport expenses and time (Jarzemskis & Vailiauskas 2007; Roso & Lumsden 2010). The flow of containers through the combination of road, rail and inland waterways associated with dry ports facilitates the flow of containers in the supply chain with faster delivery and lower costs (Migliardi et al. 2013).

3.3.2.3.2 Hinterland extension

An appropriate location of the hinterland to the seaport saves transportation costs and enhances the trade of locally produced goods within the global market (Ng & Cetin 2012). A connectivity of seaports to the hinterland through sufficient value added logistic (VAL) functions at dry ports determines the continuity of container to larger vessels, and increases the reliability of container distribution to the customers as promised (Roso et al. 2009). Replication of a seaport's role in the hinterland thus works especially well to provide documentation clearance, customised services and provide space for containers awaiting pickup, and it affects the efficiency of seaport operations positively (Roso et al. 2015)

In general, dry ports increase the proximity of a seaport to its existing or potential clients in the hinterland by imitating the seaport's functions (Roso et al. 2009). Dry ports function as an extension of the seaport to help them provide services to adjacent clients.

Simultaneously, the existence of dry ports next to the seaport client's door increases the utilisation of dry ports and enhances productivity in the land part of the transport chain (Woxenius et al. 2004).

From the seaport lifecycle, operational scale and scope of freight distribution has become stretched, and effective facilitation is needed for the extension of freight distribution on a global scale (Rodrigue 2006). Hence, at this point, the role of seaports is required to be extended through dry ports at various locations to ensure that prompt services are delivered to the clients. Dry ports play a role as an extended seaport inland to improve seaport operations and accomplish economies of scale and scope and to enhance the level of seaport competitiveness (McCalla 2007; Rodrigue & Notteboom 2010). As indicated in Chapter Two, the ability of dry ports to act as an extension for seaports is essential for prolonging the stage of their maturity and enhancing the seaport's productivity.

3.3.2.3.3 Hinterland accessibility

The use of dry port networks improves a seaport's hinterland accessibility beyond its traditional hinterland network (Tongzon 2009). The development of dry ports which prioritise inland access through road, rail and inland waterways eliminates unnecessary truck movements, balances modal split and increasingly enlarges the parameters of the hinterland market (Roso 2008). The integral components in multimodal freight such as road, rail, and waterways improve hinterland accessibility. Moreover, the limitation of seaport facilities especially in seaport storage capacity can be overcome by sufficient accessibility from the seaport to the land side (Crainic et al. 2015). Therefore, multimodal accessibility to and from dry ports assists seaports in overcoming space constraints and also provide additional advantages for seaports to improve their competitiveness.

3.3.2.3.4 Hinterland connectivity

Seaport connectivity determines the quality of the supply chain because it influences the smoothness of freight flow from one point to another. Poor connectivity in a seaport system means that the seaport is unable to fulfil the requirements of its customers and so it becomes less attractive (Notteboom & Rodrigue 2005). Seaport-hinterland connectivity via dry ports reduces transportation costs, overcomes competition and assists seaports in providing effective services to their clients (Ng & Gujar 2009).

The existence of dry ports enhances seaport hinterland connectivity by improving vertical coordination between transport modes, and it increases the density of container traffic along the transport chain as well as improving the inter-regional intermodal network (Wisetjindawat et al. 2007). Modal split through dry ports contributes to a cooperative freight distribution network which has a significant effect on environmental, social and economic benefits, reducing traffic congestion so as to improve the competitiveness of the supply chain (Wisetjindawat et al. 2007).

3.3.2.4 Increase in service variations for seaports

Dry ports provide supplementary services flexibly for seaports which can benefit the seaport's clients (Roso & Lumsden 2010). The ability of dry ports to perform as a multifunctional logistic centre assists seaports in providing these services to the clients inland and determines a sustainable growth, retaining an optimum level of competitiveness (Heiling & Voß 2016).

3.3.2.4.1 Supplementary services for seaports

Capacity constraints, space limitations and time factors prevent seaports from providing a variety of services to their clients (Roso & Lumsden 2010). Therefore, the emergence of dry ports with a wide range of services greatly assists seaports to provide optimum services such as customs inspections, warehouse and logistic services to their clients and thereby remain competitive (UNESCAP & KMI 2007; Roso et al. 2009). Research by Cruijsen et al. (2007); UNESCAP and KMI (2007) indicated that the shifting of seaport non-maritime activities to dry ports and a focusing on seaport transloading activities increased the seaport's competitiveness in the logistic network.

The emergence of dry ports in the seaport system has managed to move value adding services inland via dry ports and to reduce pressure from seaports (Andersson & Roso 2016). In addition, Notteboom and Rodrigue (2009) argue that, it is better for seaports to perform value adding services in proximity to final markets to maintain service quality and provide a range of service options for their clients. One of the key functions of a dry port is to provide value adding services as listed below to improve seaport services (UNESCAP & KMI 2007; UNESCAP 2008; Roso et al. 2009).

- Mixing and blending
- Assorting
- Marking and bar coding
- Packaging and repackaging
- Labelling and relabeling
- Replacing or repairing damaged goods
- Installing components
- Offering tailored services beyond the standard offered

- Exporting packaging for transport requirements
- Providing industry specialisations services especially for food, clothes, agricultural industry
- Providing disposal services and product advices to consignees

The ability of dry ports to provide these value adding services offers seaports the possibility of increasing their throughput without additional physical expansion at the site (Andersson and Roso 2016). Value adding services carried out by inland dry ports minimise non-maritime activities at seaports and simultaneously improve seaport throughput without additional investment on seaport expansion.

3.3.2.4.2 Flexibility

Being a part of the supply chain, a seaport needs to be flexible in responding to different stakeholders in the supply chain and it must also adapt to constant changes in the trade environment (Paixao & Marlow 2003). Fourth generation seaports emphasise flexibility and agility during operations and the involvement of dry ports in supporting them becomes a key strategy. This is because network development through regionalisation beyond the seaport perimeter involves co-operation with dry ports in their proximity (Varhoeven 2010). The seaport alone is unable to achieve competitiveness because of its rigidity and the requirements from its environment which need an external focus and high flexibility, especially through intermodal terminals (FDT 2007). Dry ports which are well known for their operational agility and flexibility assist seaports to be flexible towards changes in the global trade environment.

The offering of services by dry ports which cannot be provided by seaports adds flexibility and increases their value to seaport operations. From a strategic perspective, seaports can

develop an entrepreneurial role in this respect by making direct investments in the hinterland and by being involved in the development of strategic partnerships with dry ports (Notteboom & Winkelmanns 2001; Notteboom & Rodrigue 2005). By this strategic partnership, meeting customer requirements and rapidly responding to customer demands can be achieved. Hence, the involvement of dry ports increases the flexibility of seaport operations and assists this node to adapt to new dimensions of trade and thereby remain competitive (Cetin & Cerit 2010). Therefore, adapting to rapid changes in global trade especially from shipping alliances and through the development of intermodal transportation or the introduction of new regulations from the International Maritime Organisation will be an easy task for seaports that have the assistance of dry ports.

3.3.2.5 Increase in seaport trade volume

To pursue the growth of trade, seaports consider the capacity form of dry ports as an added advantage for them in achieving their aims. The following sections discuss how dry ports contribute to seaport container trade measured by the continuity of container flow to and from the seaport and the volume of transshipment containers generated by the dry ports (Vernimmen et al. 2007).

3.3.2.5.1 Continuity in container flow

The integration between seaports and dry ports enhances continuity in container flow to and from seaports (Werikhe & Jin 2015). A dry port plays an effective role as a consolidation centre of maritime goods from manufacturers, a centre for regional development and a distributional centre of local, regional and international containers (Werikhe & Jin 2015). The transport link between a seaport and other stakeholders, including manufacturers, via a dry port provides strong possibilities for reducing

unnecessary trips and increasing infrastructure utilisation by providing sufficient volume of containers to seaports (Allen 2007).

Proximity to manufacturers, a high demand from the hinterland, a connection to major shippers, FTZ in the seaport hinterland, and freight corridors are some of the factors that determine the continuity of container flow to and from a seaport (Notteboom 2006; Ng & Gujar 2009; Roso & Lumsden 2010). Dry ports with sufficient transportation links and the location of their terminal near manufacturers promise steady continuity in container volume to seaports.

3.3.2.5.2 Transshipment containers

The inability to provide transshipment services to fleets reduces the frequency of shipping services and their connection with international seaports, which subsequently affects the attractiveness of seaports (Lam & Yap 2011). According to Lirn et al. (2004), intermodal links is one of the main criteria when selecting a seaport for transshipment. Hence, dry ports providing intermodal links are able to assist seaports in managing transshipments (Roso & Lumsden 2010; Ng & Cetin, 2012).

For transshipment containers, seaports are regularly requested to act as buffers and consistently accommodate the request of their clients concerning last minute schedule alterations such as delays, break of calls and requirements for additional yard storage (Notteboom 2006). Conversely, any seaports which are unable to provide this flexible operational procedure will lose their competitive edge and create a negative identity for the entire supply chain (Acciaro & McKinnon 2013).

Research by Rodrigue and Notteboom (2012) indicated that transshipment containers included foreland containers and cross inland border containers. This transshipment pattern

is normally found near country borders alongside value adding logistic activities. For example, dry ports in western China perform transshipment activities to main Chinese seaports by distributing and consolidating containers to and from Russia, Central Asia and South Asia (Beresford et al. 2012). A dry port can assist a seaport in tackling issues such as last minute changes in shipping lines, requirements for additional space for transshipment containers and bringing flexibility to seaport operations.

Based on Henttu and Multaharju (2011), the cost for transshipment handling solely at the seaport is more expensive than that incorporated within an inland terminal. Thus, the engagement of dry ports in seaport transshipment operations reduces transshipment costs, and as a result may increase the volume of transshipment containers.

3.5 Summary

The major influencing factors of dry port operations and how they contribute to seaport competitiveness have been discussed in this chapter. Worldwide experiences of dry port operations show that hinterland conditions, service features, government policy, capacity and information sharing are the main factors influencing dry port operations. It is found that dry ports from various continents simplify the complex function of seaports to the different players inland.

The experience of dry ports from other regions indicates that the functions and services that dry ports offer greatly affect seaport competitiveness by enhancing the seaport's performance, improving its capacity, improving seaport-hinterland proximity, increasing the variations in the seaport's services and increasing the trade volume of the seaport.

This review of the literature in Chapter Two and Three has outlined the key factors of the role, functionalities and challenges of dry ports in the container seaport system. The factors

that influence dry port operations and the impacts of dry ports on seaport competitiveness have also been identified and discussed. However, the findings of literature review show that there is not any empirical study on dry ports in Malaysia. Of notice is that it lacks of an empirical study on the impact of dry port operations on container seaport competitiveness. This gap justifies the need for this study. These factors from these two chapters are referred to later to explore the influential factors of dry port operations in Malaysia and examine whether dry ports enhance the competitiveness of container seaports

The next chapter introduces the background of this research, the Malaysian container seaport system and its components.

CHAPTER FOUR

MALAYSIAN CONTAINER

SEAPORT SYSTEMS

4.1 Introduction

Chapter Two explained the functions, roles, types and challenges of dry ports in the container seaport system, while, Chapter Three introduced the factors that influence dry port operations and the impact on the container seaport competitiveness. In general, the discussion of these two chapters is based on the global experience of dry port operations. The findings of the previous two chapters help the researcher conduct an empirical study of dry port development and operation in the Malaysian context, which had not been carried out yet.

This chapter introduces the background to this research by describing Malaysia's geographic features and discussing components of Malaysian container seaport systems. The components include freight corridors, container seaports, dry ports and multimodal transportation. It provides an overview of current management, operations and development of each component of the container seaport system. Connectivity within the container seaport system, in particular seaports, dry ports and hinterland connectivity, is also evaluated in the final section of this chapter.

4.2 Geographic features

Geographically, Malaysia is located in Southern Asia and covers a land area of about 399,323 square kilometres, consisting of 11 states in peninsular Malaysia and two states in Borneo Island. Peninsular Malaysia occupies a land area of approximately 198,160 square kilometres and has its border with Thailand in the north and Singapore in the south (Figure 4.1). The land area of both states in Borneo Island covers about 200,565 square kilometres and has its frontier with Indonesia's Kalimantan in the south and Brunei in the north (Taib 2011).

Malaysia's total coastline is 4,675 kilometres in length, and three quarters of Malaysia's total land is exposed to seas which thereby emphasises the importance of maritime trade to the country. This has been further evidenced by the growth of shipping and seaport activities over the past few decades which continue to provide economic development for Malaysia (Nazery 2013).

Malaysia's geographical location is advantageous and has contributed to the development of container seaports in Malaysia. This specific advantage also determines the high dependency of its national trade and economy on maritime business. For example, container freight equated to 329.9 million tonnes compared to 179.0 million tonnes for non-containerised cargo in all main container seaports in 2013 (MOT 2014).



Figure 4.1: Location of Malaysia
Source: Nations Online (2015)

4.3 Freight corridors in container seaport systems

According to Rodrigue (2004), a freight corridor is a linear accumulation of transport infrastructures servicing global and regional flows. Freight corridors provide physical capacity including multimodal transportation, gateways and intermodal terminals for the purpose of effective freight distribution. In Malaysia, freight corridors are classified as intra-regional within the nation and inter-regional, i.e. between nations, including Thailand, Singapore and other countries in Southeast Asia (Ninth Malaysia Plan 2006). The following sections discuss these freight corridors and the connection of multimodal transportation, seaports and dry ports in each freight corridor.

4.3.1 Intra-regional freight corridors

There are four major freight corridors in peninsular Malaysia, namely northern, central, southern and east coast freight corridors (see Figure 4.2). Each freight corridor incorporates several economic development plans initiated by the Malaysian government. Each development plan is designed for a specific region, i.e. north, central, south and the east coast of peninsular Malaysia. The central freight corridor, for example, is the outcome of the New Development Policy established in the early 1990s (EYGM 2014).

The North Corridor Economic Region (NCER) Development Plan commencing in 2007 supports the freight task along with the north freight corridor; and the Iskandar Malaysia (IM) Development Plan starting in 2006 supports the southern freight corridor; and the East Coast Economic Region (ECER) Development Plan commencing in 2007 supports the freight task for the east coast freight corridor (see Table 4.1). There are two main freight corridors in east Malaysia called the Sarawak Corridor of Renewable Energy (SCORE) and the Sabah Development Corridor (SDC), which focus on manufacturing, infrastructure, tourism and the petrochemical industry (Tenth Malaysia Plan 2011).

However, those two corridors are not included in this research because their locations are very far away from the peninsular Malaysia where the three major container seaports included for this research, are located.

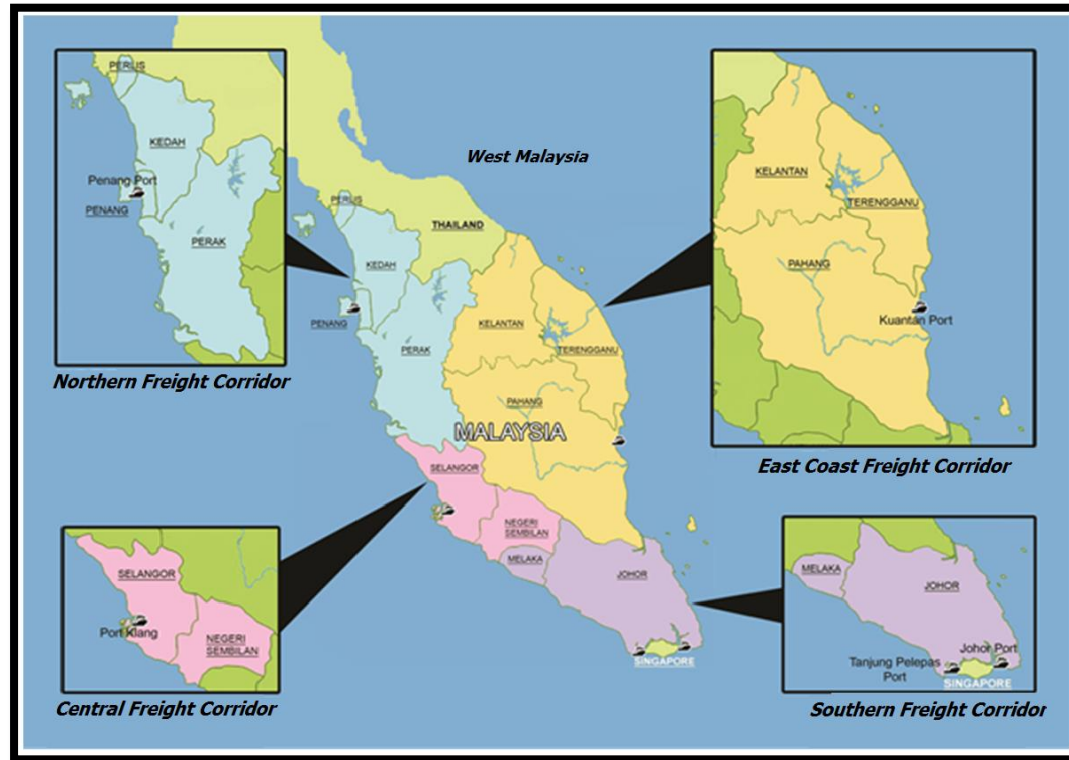


Figure 4.2: Location of freight corridors in peninsular Malaysia
Source: Adapted from Nasir (2014)

Four freight corridors are actively involved in the container freight distribution of peninsular Malaysia. According to MOT (2015), the total container freight volume recorded in each freight corridor between 2010 and 2014 was 5,826,132 TEUs in the northern freight corridor; 49, 443,465 TEUs in the central freight corridor; 40, 607,824 TEUs in the southern freight corridor; and 668,583TEUs in the east coast freight corridor. Those figures indicated that these freight corridors play a critical role in container freight distribution in peninsular Malaysia. Detailed discussion on each freight coordinator is undertaken in the following.

1. Northern Freight Corridor

In the northern freight corridor, Bukit Kayu Hitam, Padang Besar, Pengkalan Kubor, Prai, Mak Mandin, Kulim and Bayan Lepas and Hatyai in Thailand are the main consumption points. Each of these consumption points originated from a different state including Penang, Kedah, Perlis, Perak and Thailand. The NCER economic development plan aims to turn northern peninsular Malaysia into a world-class economic region by contributing to the freight task in the northern freight corridor. This development plan covers an area of 17,815 square kilometres and mainly promotes the development of the agriculture, human capital, infrastructure, manufacturing and tourism sectors (Ngah 2010). NCER is expected to generate 3.1 million job opportunities and almost USD 55 billion has been invested for implementation (Tenth Malaysia Plan 2011).

In this corridor, Penang Port is the main gateway to serving all regions of northern peninsular Malaysia, including Southern Thailand. In order to connect to these hinterlands, there are two main dry ports involved, namely PBCT and ICT which are located 150 kilometres and 181 kilometres from Penang Port respectively (Chen et al. 2015). Additionally, there are two inland clearance depots close to Penang Port, i.e. Bukit Kayu Hitam Inland Clearance Depot and Prai Inland Clearance Depot, which are located 135 kilometres and 10 kilometres from Penang Port respectively.

Table 4.1: An overview of intra-region freight corridors in Malaysia

<i>Freight Corridors</i>	<i>Northern Freight Corridor</i>	<i>Central Freight Corridor</i>	<i>Southern Freight Corridor</i>	<i>East Coast Freight Corridor</i>
Regional development plan	Northern Corridor Economic Region (NCER)	Central Corridor	Iskandar Malaysia (IM)	East Coast Economic Region (ECER)
Government authority	Northern Corridor Implementation Authority (NCIA)	Government of Malaysia	Iskandar Region Development Authority (IRDA)	East Coast Economic Region Development Council (ECERDC)
Started (year)	2007	1991	2006	2007
Objective(s)	World-class economic region	Equitable growth and economic development	Sustainable metropolis of international standard	A developed region-distinctive dynamic and competitive
Radius of coverage	17,816 square kilometres	15,033square kilometres	22,874 square kilometres	66,736 square kilometres
State of coverage	Penang, Kedah, Perlis &Perak	Negeri Sembilan, Selangor and Kuala Lumpur	Johor and Malacca	Pahang, Kelantan and Terengganu
Focus industry	Agriculture, human capital, infrastructure, manufacturing, logistic and tourism	Human capital, infrastructure, manufacturing, service sector, agriculture	Education, financial health care, ICT, creative industries, logistic, and Tourism	Agriculture, education, manufacturing, oil, gas, petrochemical, and tourism
Expected employment (million)	3.1	9.8	1.4	1.9
Expected investment (USD billion)	55	559	118	35

Sources: Adapted from Ngah (2010);Tenth Malaysia Plan (2011)

This corridor utilises multimodal transportation connecting different transport nodes and hinterlands, including road and rail, in particular the Malaysian Thailand landbridge (MTL), thereby providing substantial benefits in freight transportation efficiency (Humphries 2004; Ngah 2010). All dry ports in the northern corridor are connected to Penang Port through rail and road transport, while the clearance depots are linked only by road. This freight corridor is also equipped with the North-South Expressway which connects the border of Thailand in the north to the border of Singapore in the south, over a distance of approximately 772 kilometres (PLUS 2011). Rail links in this freight corridor contribute almost 80% of the container transportation in the nation (Malaysian Railway 2016).

The northern freight corridor also includes Penang Island. Other than by ferry, the only link previously connecting Penang Port to Penang Island is the first Penang Bridge. This bridge has a low capacity of only four lanes (two in each direction) to cater for the catchment zone in Penang Island (ASIRT 2015). However, the opening of the second Penang Bridge in 2014 and the expansion of lanes for the first bridge from four to six has improved the connectivity for the northern freight corridor. Figure 4.3 shows the main components involved in the northern region freight corridor.

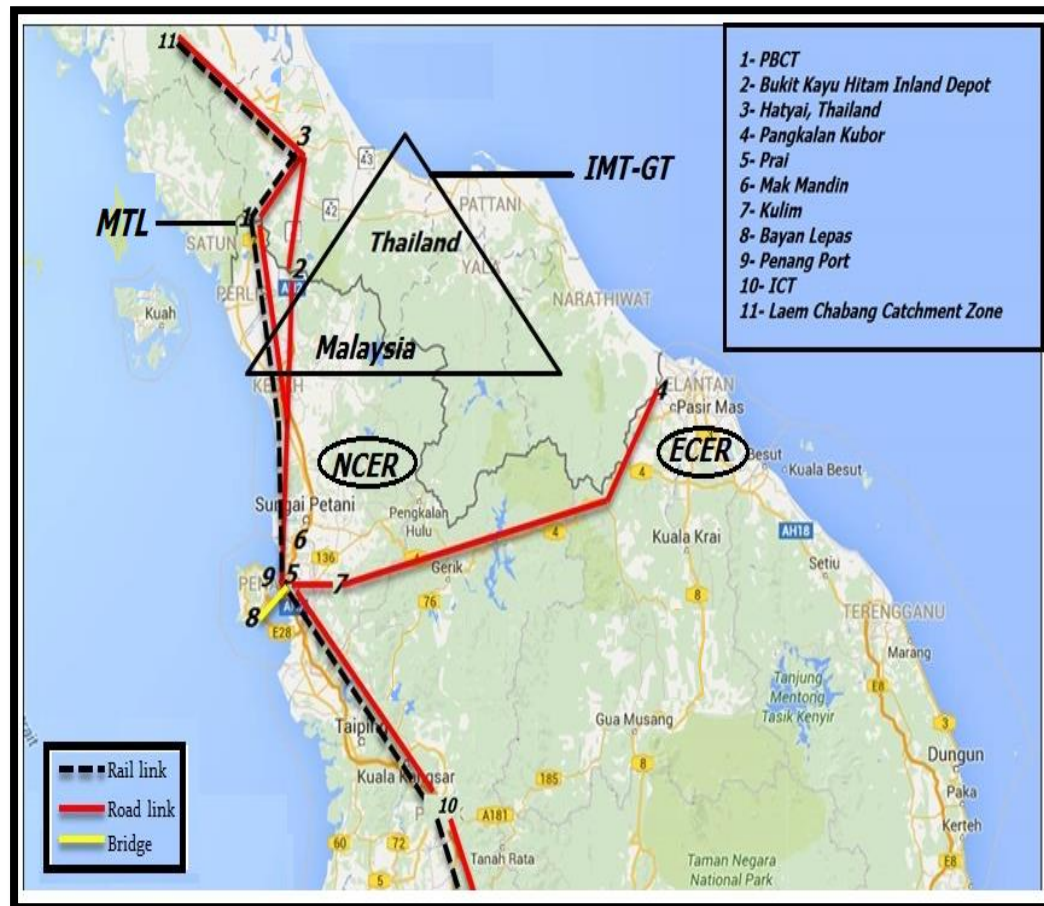


Figure 4.3: Components in the northern freight corridor
Source: Adapted from Nasir (2014)

2. Central Freight Corridor

The central freight corridor, which connects manufacturers from the states of Negeri Sembilan, Selangor and Kuala Lumpur, is the key economic development region for Malaysia. This corridor has developed significantly following the introduction of the New Economic Development Policy in 1991 (EYGM 2014). It has been equipped with well-developed industrial parks, highways and rail infrastructure which are opportunities for effective operations of the seaports and dry ports.

Kapar, Bukit Jalil, Shah Alam, Selayang, Subang, Nilai, Padang Besar and Kuantan in Malaysia and Hatyai in Thailand are the major cities serviced by the central freight corridor. This freight corridor is supported by the development plans NCER, ECER and the Indonesia-Malaysia-Thailand-Growth Triangle (IMT-GT) which generate more freight

for this corridor. These zones are the main source of freight for the central region of peninsular Malaysia and channelling containers to Port Klang. Kuala Lumpur and Selangor, as hubs for the nation's economic activity, constantly drive the demand and supply of containers for Port Klang. The fastest growing hinterlands, such as Shah Alam and Nilai, always have an essential role in economic development in this central region by supporting the operations of seaports and inland freights, providing opportunity for employment and economic development in the region.

Central corridor is equipped with a major seaport, Port Klang, as well as dry ports and inland clearance depots, and multimodal transportation to undertake the freight task. The dry ports serving this freight corridor include SIP and NIP. All dry ports are connected to Port Klang at distant ranging from 93 kilometres to 558 kilometres through either road or rail transportation. Port Klang is also connected to Sungai Way inland clearance depot which is located 36 kilometres from the seaport through road transportation (Chen et al. 2015). Port Klang is also linked to all nations in South East Asia (SEA) through rail and road (Humphries 2004; Ngah 2010). This indicates that Port Klang is widely connected through ocean and inland transportation.

Sungai Way inland clearance depot is connected via road to Port Klang in order to perform as an immediate buffering zone for Port Klang and provide space for the manufacturers to locate their empty containers (Nazery 2014). Figure 4.4 shows the key players, inland freight facilities, transport linkages and the main node which actively participates in central region freight corridors. The connection between industrial parks and multimodal options provide an advantage for dry port operation in the central region compared to the other freight corridors. These components provide a steady continuity of containers to and from seaports through dry ports.

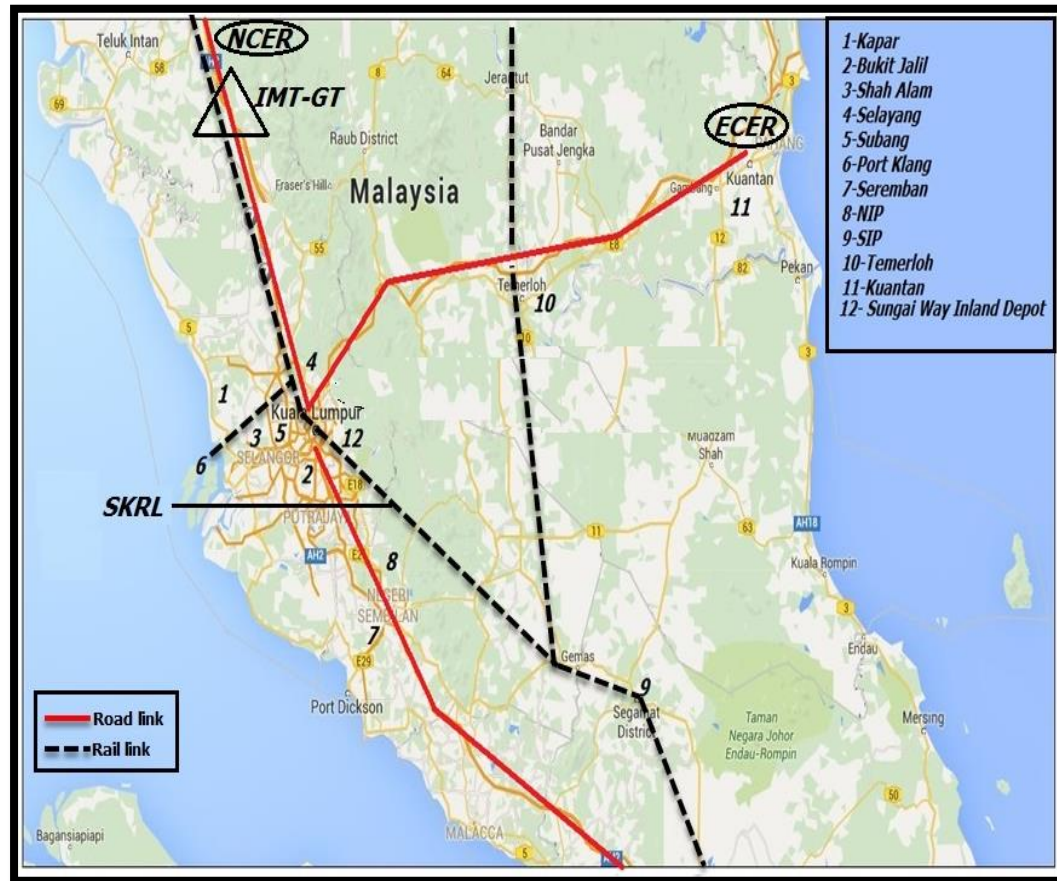


Figure 4.4: Components in the central freight corridor
Source: Adapted from Nasir (2014)

3. Southern Freight Corridor

The main sources of freight to the southern freight corridor are from Pasir Gudang, Nusajaya Tech Park, Tanjung Langsat Industrial Park, Air Keroh Industrial Estate in Malaysia and Jurong in Singapore. The economic development plans IM and Indonesia-Malaysia-Singapore-Growth Triangle (IMS-GT) help to provide continuity in the container volume from these regions. In the southern freight corridor, IM was introduced in the south of peninsular Malaysia in 2006. The objective of IM is to develop a strong and sustainable metropolis of international standing (Nghah 2010). IM covers almost 2,216 square kilometres and focuses on industries, logistic and tourism development. A total of

1.4 million new job opportunities will be generated through IM and the total investment for this corridor is almost USD 118 billion (Tenth Malaysia Plan 2011).

In this corridor, the seaport PTP is the main gateway to serving all regions in southern peninsular Malaysia including Singapore. PTP is connected by three main dry ports including ICT, SIP and NIP, with their locations ranging from 188 kilometres to 551 kilometres from this seaport (Chen et al. 2015).

Road and rail networks are used to undertake the freight task along this freight corridor (Humphries 2004; Ngah 2010). This freight corridor is connected by rail links to all hinterlands except Malacca and Singapore because there is no rail link to these regions (Chen et al. 2015). Additionally, this freight corridor is equipped with the North-South Expressway which connects all states in west coast peninsular Malaysia with Singapore (PLUS 2011). The southern freight corridor connects to Singapore by two main bridges, Causeway Bridge and Second Link Bridge. Causeway Bridge has become the main route for haulier operators because the distance to Singapore is shorter than that of Second Link Bridge (Barter 2006). Causeway Bridge relatively decreases the freight transportation cost compared to the Second Link Bridge (Barter 2006). In addition, Causeway Bridge's capacity, fast checkpoint procedure and fewer charges for freight vehicles have become attractive features that were developed by the Singapore Government in order to enhance crossborder trading. Figure 4.5 indicates key components in the southern freight corridor.

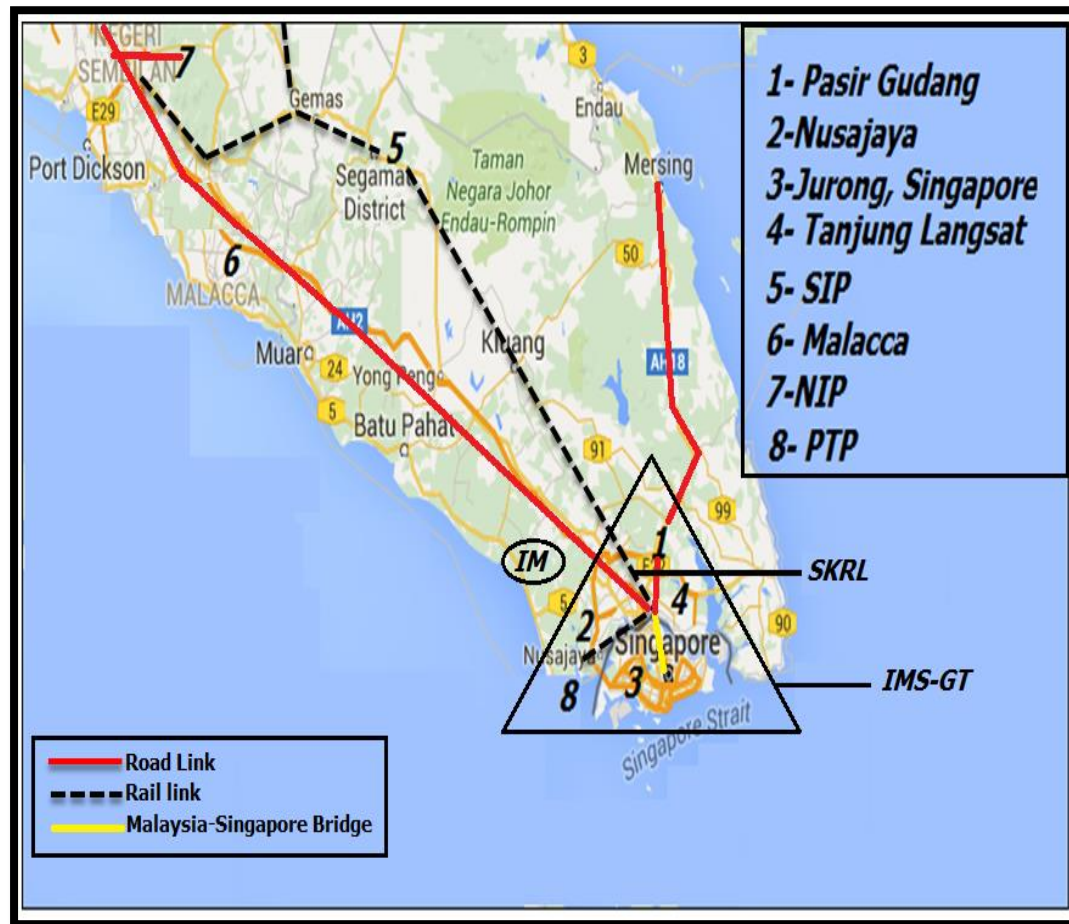


Figure 4.5: Components in the southern freight corridor
Source: Adapted from Nasir (2014)

4. East Coast Freight Corridor

Terengganu, Kuantan and Kelantan are the main states covered by the east coast freight corridor. These states have 10 main regions, namely Pasir Mas, Besut, Setiu, Kuala Terengganu, Dungun, Kerteh, Chukai, Kuantan, Gambang and Pengkalan Kubor, actively contributing to the container volume in this corridor (see Figure 4.6). The economic development plan ECER in the east coast freight corridor was introduced in east coast Malaysia in 2007 and contributed to the freight task of this corridor. The main objective of ECER is to develop the east coast into a distinctive, dynamic and competitive region. The manufacturing, petrochemical, agricultural and tourism industries are the main areas of

focus in this corridor (Ngah 2010). ECER is projected to generate almost 1.9 million new jobs with total investment being around USD 35 billion (Tenth Malaysia Plan 2011).

In this corridor, Kuantan Port is the main gateway serving all the regions of east coast peninsular Malaysia. However, Kuantan Port was designed to handle bulk cargo including liquid cargo, bulk cargo and petrochemicals rather than containerised cargo (Ghani et al. 2011). The proportion of bulk cargo to containerised cargo at Kuantan Port is 82:18 (KPA 2014). In addition, there are few direct calls to the European and USA markets from Kuantan Port, therefore the east coast shippers/manufacturers prefer to utilise seaports on the west coast by shifting their cargo to Penang Port and Port Klang for fast shipment (Ghani et al. 2011).

However, there is no rail link in Terengganu and most of the containers from this state to the west coast are transported by road. The rail link in west coast Malaysia is between Tumpat in Kelantan and Gemas in Johor via Kuantan, as indicated in Figure 4.6 (Malaysian Railway 2012). The transportation constraint limits the development of container freight and affects the performance of the west coast seaports. Low container volume compared to bulk cargo could be another reason why freight transportation in this region remains less developed compared to that on the west coast.

This east coast freight corridor is connected to the Bukit Kayu Hitam Inland Clearance Depot and PBCT, for transporting the container to Penang Port. The dry port and inland depot are located between 385 kilometres to 417 kilometres from the main hinterlands along the east coast freight corridor. For the freight distribution from the east coast to Port Klang, SIP and Sungai Way Inland Container Depot are involved. The dry port and inland depot are located between the ranges of 172 kilometres to 248 kilometres from the main hinterlands of east coast Malaysia.

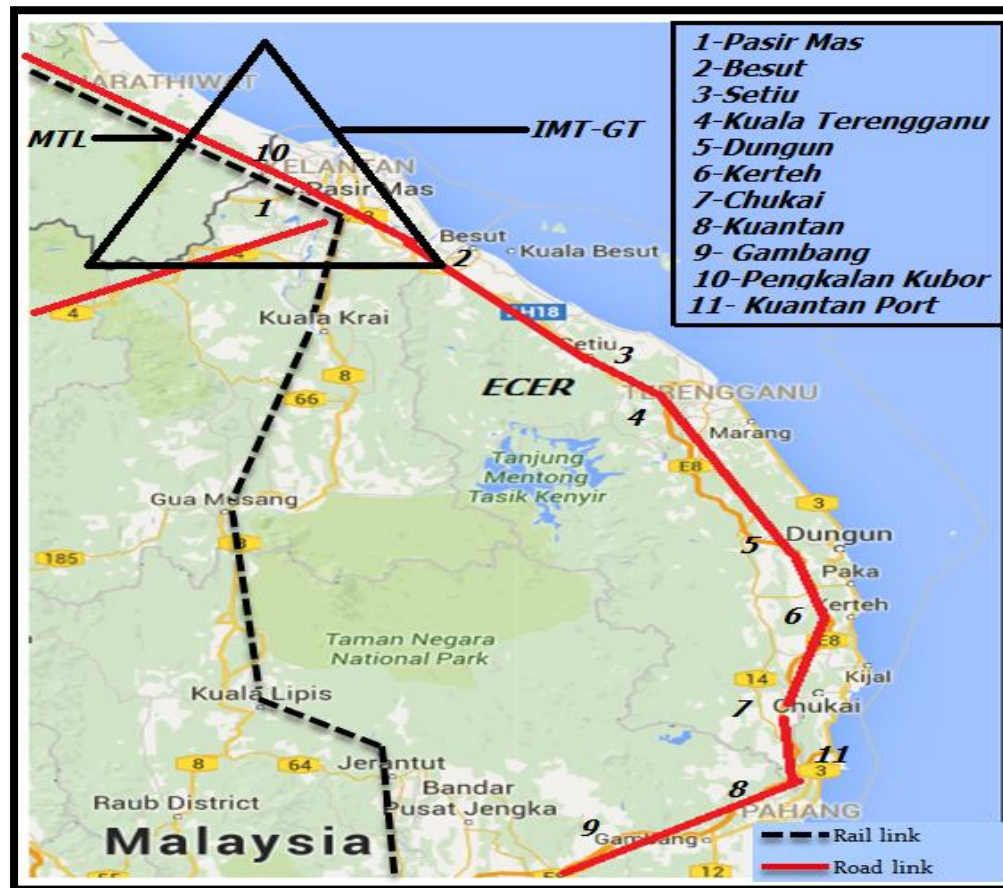


Figure 4.6: Components in the east coast freight corridor
 Source: Adapted from Nasir (2014)

4.3.2 Inter-regional freight corridors

The strategic location of Malaysia presents an opportunity for involving neighbouring countries in freight corridors in order to amplify its economic progress. There are three (3) inter-regional freight corridors involving Malaysia, Thailand, Singapore, Indonesia and Brunei. These include the Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT), Indonesia-Malaysia-Singapore Growth Triangle (IMS-GT) and Brunei-Indonesia-Malaysia-Philippines-East Asian Growth Area (BIMP-EAGA) (Figure 4.7).

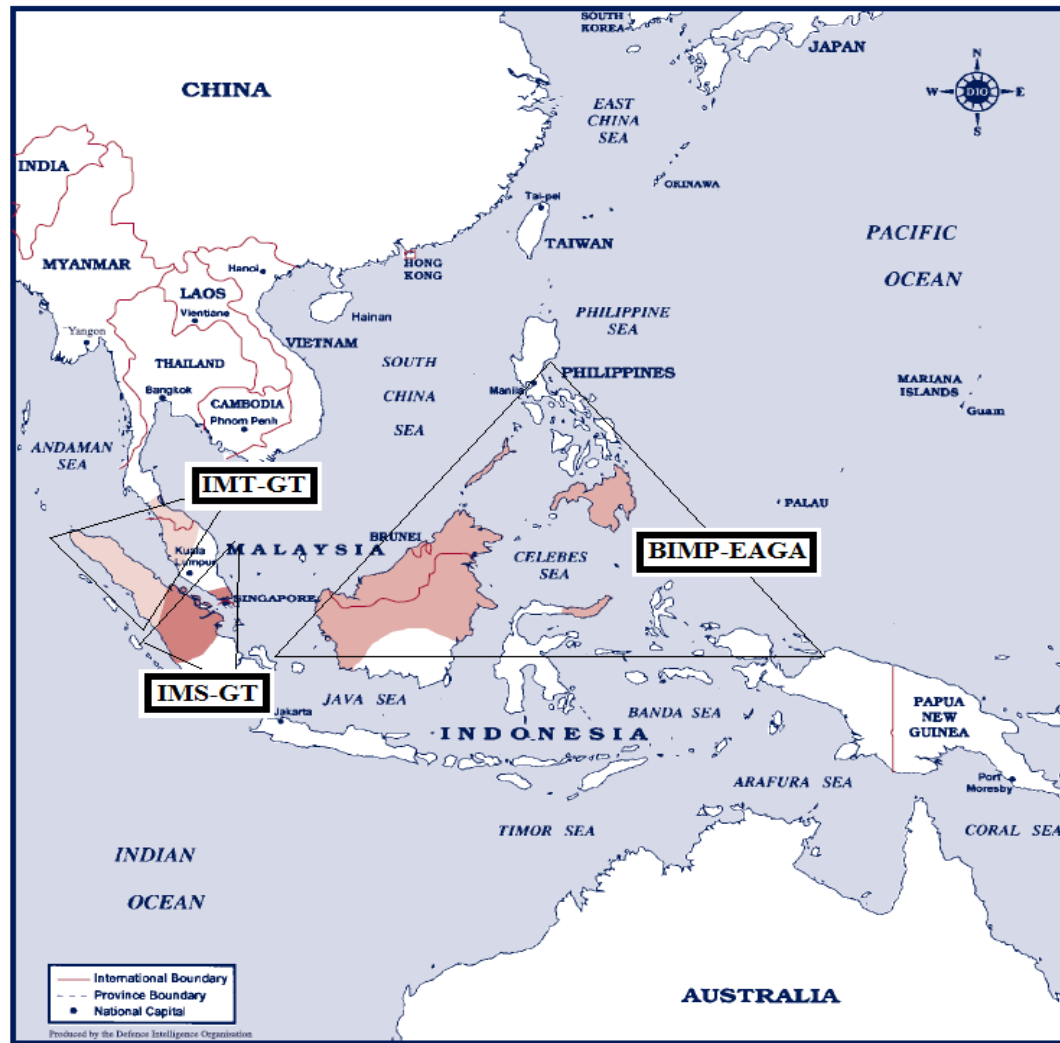


Figure 4.7: Partners in the South East Asia Growth Triangles
Source: Adapted from Humphries (2004)

1. Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT)

IMT-GT is a sub-regional economic development plan established in 1993. The vision of this cooperation is to accelerate economic transformation between Indonesia, Malaysia and Thailand (IMT-GT 2012). Its intention is to facilitate and promote trade among the members, strengthen the infrastructure linkages to support the integration of IMT-GT sub-regions, develop human resource competencies and enhance public-private sector collaboration (IMT-GT 2012). Almost USD 5,218 has been invested in these three countries for main sectors such as transportation, trade, agriculture, food, tourism and human resource development (Rahim et al. 2014).

Southern Thailand is the main freight provider for PBCT and Penang Port and in fact the main rail freight of the nation originates from this region. For example, some regions including Laem Chabang (95,000 TEUs), Songkhla (25,885 TEUs), Bangkok (16,513 TEUs) and Bettong (7,386TEUs) were actively providing containers to Malaysian seaports and dry ports in 2011 (Sullivan 2011). Malaysia and Thailand utilise the Malaysia-Thailand Landbridge which operates two trips every two months (Chen et al. 2015). As well as the landbridge system, manufacturers from Thailand also utilise the highway network from Padang Besar–Bukit Kayu Hitam Inland Clearance Depot–Penang Port–ICT–Port Klang.

In Malaysia, this IMT-GT has potential to improve crossborder infrastructure and increases the quality of transport service connections between Malaysia, Thailand and Indonesia. The cooperation with Thailand and Indonesia provides transport facilitation for container transportation across the region (Rahim et al. 2014). Anticipated results from IMT-GT implementation include facilities and infrastructure upgrades, involvement of private investors to be a part of public projects, large-scale development of Economic Zones, new manufacturing parks, expansion of customs, and immigration as well as quarantine (IMT-GT 2012). The northern region of Malaysia has strong potential to generate a high volume of trade from this network which will be beneficial for Malaysian container terminals because of its location adjacent to the container catchment zone in southern Thailand.

2. Indonesia-Malaysia-Singapore Growth Triangle (IMS-GT)

IMS-GT was initiated by Singapore in 1990 to enhance cooperation between Indonesia, Malaysia and Singapore. This collaboration has invested almost USD 27.7 million in these three countries, especially for the development of transportation equipment (Sparke et al.

2004). This cooperation has generated more investment in southern Malaysia whereby many investors invest in industrial estates, improving industrial facilities, and encouraging the dispersal of new industries to rural areas. Moreover, the establishment of IMS-GT has improved the availability of quality labour by developing a new training institute, increased transport infrastructure, particularly road and seaports, and streamlined the customs procedures for freight transportation between these three regions (Humphries 2004).

Currently, Malaysia and Singapore are connected via the North-South Highway First Link and the Malaysia-Singapore Second Link respectively (PTP 2015). However, there is no rail freight link between these two nations. In future, the development of the Singapore-Kunming Rail Link will be the pioneer project which will improve rail freight connectivity between Malaysia and Singapore (ASEAN 2011).

IMS-GT attempts to harmonise and simplify the rules and regulations relating to land laws, labour market policies, crossborder procedures and other formalities to improve and increase the attractiveness of these regions to foreign investors (Humphries 2004; Sparke et al. 2004). The introduction of IMS-GT creates a healthy network in trade and at the same time utilises the existing trade networks especially in southern region of Malaysia.

3. Brunei-Indonesia-Malaysia-Philippines-East Asian Growth Area (BIMP-EAGA)

BIMP-EAGA is the current collaboration between Brunei, Indonesia, Malaysia and the Philippines which was initiated by the Philippines in 1992 (Annuar 1994). The objective of this collaboration is to capitalise on economic linkages by utilising existing trade and investment, increasing both domestic and foreign investment flow to the sub-region by promoting export-oriented industrialisation, and promoting balanced economic development in each region.

The main focus of this collaboration is on transport and shipping services, tourism and fisheries cooperation (Annuar 1994). Therefore, the mechanism for the BIMP-GT implementation is by facilitating free movement of goods within the participating countries, sharing common facilities and implementing appropriate economic development activities in each region (Ishak & Kasim 2004). Figure 4.7 shows the partners in the SEA growth triangles.

4.4 Container seaports

In Malaysia, seaports are the main gateways for maritime trade and play a key role in the nation's economic growth (Soon & Lam 2013). They are classified as federal seaports and state seaports. The federal seaports are governed by federal statutory bodies under the Ministry of Transportation while state seaports are governed by state governments (MOT 2014).

Port Klang, Penang Port, Johor Port, Kuantan Port, Bintulu Port and Malacca Port are categorised as federal seaports, while Lumut Port, Kota Kinabalu Port, Kuching Port and Miri Port are examples of state seaports (MIMA 2014). In addition to federal and state seaports, there are also secondary seaports and jetties under the jurisdiction of the Marine Department and managed under the Merchant Shipping Act 1952 (Figure 4.8), and owned and operated by oil companies, tourism sectors and fisheries sectors (MIMA 2014).

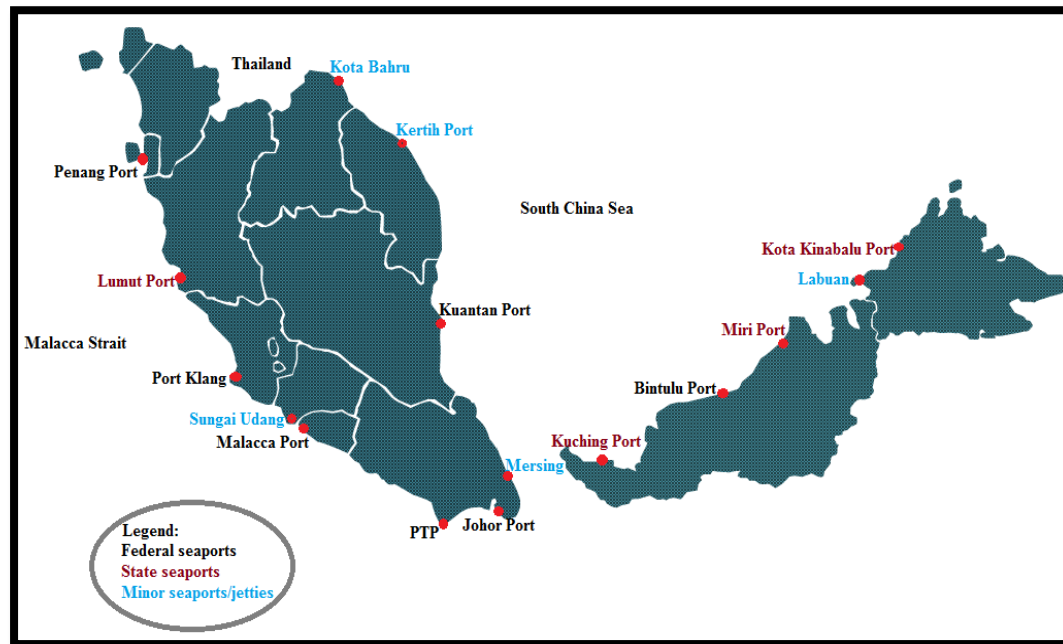


Figure 4.8: Location of various seaports in Malaysia
Source: Adapted from MIMA (2014)

From the administration perspective, all federal seaports are governed by the Ministry of Transport (MOT) under the supervision of the Maritime Division. The state seaports are under the jurisdiction of the State Ministry (MIMA 2015). Each federal seaport is assisted by terminal operators. For example, Port Klang Authority is assisted by West Port and North Port. Johor Port and PTP are the operators for Johor Port Authority. There are two operators each assisting Penang Port Commission, Malacca Port Authority and Kuantan Port Authority respectively and one operator for Bintulu Port Authority as shown in Figure 4.9. Seaport authorities play the role of regulator, supervisor and facilitator for the seaport operators' activities. According to the Port Authorities Act (2006), seaports authorities in Malaysia are responsible for the following tasks:

- Providing trade facilitation such as provision of seaport Electronic Data Interchange (EDI), inter-port cooperation and strategic marketing plan.
- Setting and enforcing regulations especially in navigation control, safety and security and environment protection.

- Planning for future seaport development including infrastructure development, long-term planning and coordination with regional development.
- Ensuring seaports balance development based their dynamic, specialisation, infrastructure and hinterland facilitation.
- Setting and verifying standards of performance.
- Providing licences and permits of operation.
- Monitoring fair competition between seaports.
- Managing the seaport's assets.

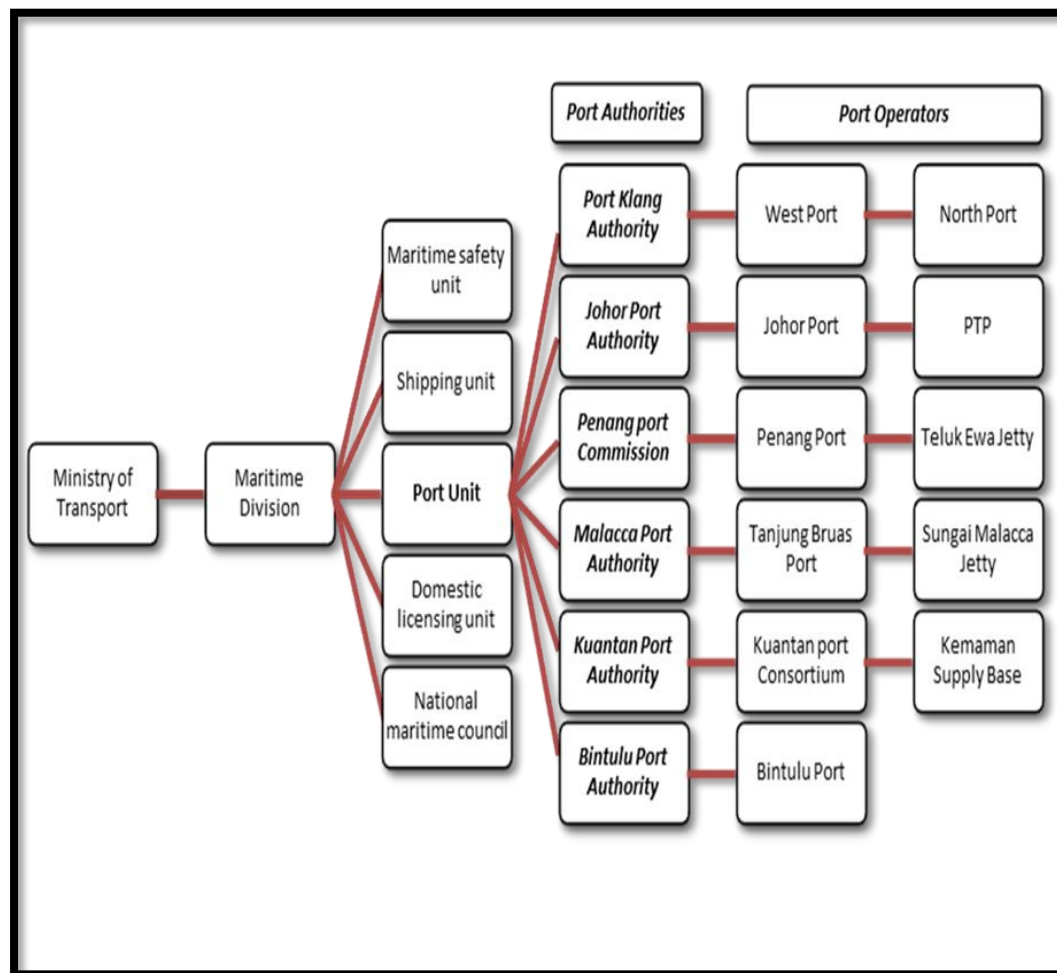


Figure 4.9: Organisational structure of Malaysian seaports administration
Source: Adapted from MIMA (2014)

The main container seaports in Malaysia are discussed as follows.

1. Port Klang

Port Klang was privatised into a container terminal in 1986 and the establishment of two seaport operators starts from here (PKA 2014). There are two private operators for Port Klang, namely West Port and North Port. Both West Port and North Port focus on containers and conventional cargo handling (PKA 2014). In world rankings, Port Klang was ranked 13th out of 30 container seaports in the world in 2014 (Alphaliner 2015). West Port and North Port contributed about 67% and 33% of the containers to Port Klang respectively (Salisbury 2014). From the container breakdown in each terminal, 71% of the containers in West Port are for transshipment and 29% for import and export, while in North Port about 48% of the containers are for transshipment and 56% are for import and export (Salisbury 2014).

Port Klang, also known as the National Load Centre, plays a crucial role as a main container hub for the regional and economic development of the country. The location of this seaport on the crucial trade lane of Malacca Strait makes Port Klang attractive to many ships on the eastbound leg and the last port of call on the westbound leg of the Far East–Europe trade route (PKA 2014). Since the government hubbing strategies that were pursued in 1993, the facilities and services in Port Klang are synonymous with those of a world-class port, having trade connections with over 120 countries and more than 500 ports around the world (PKA 2014).

2. PTP

PTP is an operator for Johor Port Authority. PTP is recognised as the second largest container seaport in Malaysia. PTP began its operation at the end of 1999 and serves as

primary hub for Maersk and Evergreen in Southeast Asia (PTP 2014). PTP is known as an ideal seaport for regional and global transshipment activities (JPA 2014). In world rankings, PTP recorded 7.63 million TEUs and ranked 19 out of 30 container seaports around the world in 2014 (Alphaliner 2015). Accessibility to Singapore by national highway and connection to the national rail grid in the future places PTP in an ideal position for crossborder transactions through an intermodal network by 2015 (MITI 2013).

3. Penang Port

The landlord for Penang Port and Teluk Ewa Jetty is Penang Port Commission which was established in 1956 (PPC 2014). Penang Port is an international seaport located strategically at the northern entrance of the Strait of Malacca. Penang Port handles various cargo, namely containers, bulk cargo and general cargo (PPC 2014).

Penang Port has become an important hub by benefiting from the development plan of NCER and Indonesia-Malaysia-Thailand Growth Triangle economic corridors (IMT-GT), which encourage container traffic from the northern region of peninsular Malaysia and Southern Thailand (PPC 2014; Chen et al. 2015). Meanwhile Teluk Ewa Jetty is designed to handle petroleum products, coal, cement and general cargo. It is also used as a passenger terminal for tourism purposes. This jetty facilitates the cement trade to Myanmar, Hong Kong and Bangladesh (Nazery et al. 2011).

4. Malacca Port

Malacca Port is the regulator for Tanjung Bruas Port and Sungai Malacca Jetty. Tanjung Bruas Port is designed as a passenger terminal but also handles various general cargo such as maize, flour and steel coil (Nazery et al. 2011). Huge competition from Port Klang and PTP stops Malacca Port from being attractive and expanding on container business.

Therefore, this seaport remains as a feeder seaport in west coast Malaysia and concentrates on general cargo handling (Nazery et al. 2011).

5. *Kuantan Port*

Kuantan Port started to operate in 1974 and this seaport is located within the main trade corridor in east coast Malaysia. The first operator for Kuantan Port is Kuantan Port Consortium handling liquid bulk, containers and general cargo (KPA 2014). This seaport is strategically located next to the South China Sea which is the main trunk route accessing the Asia Pacific region and the Asian and Far East markets (Nazery 2007). The second operator for Kuantan Port is Kemaman Supply Base, a leading petroleum supply base in east coast Malaysia. This operator provides berthing facilities for oil tankers, bunker services and warehousing services (KSB 2014).

6. *Bintulu Port*

Bintulu Port is located in east Malaysia, offering services such as dry bulk, container, liquid bulk and general cargo handling through its operator, Bintulu Port (BPA 2014). However, this seaport depends more highly on LNG cargo rather than containers, with the proportions being 60:40 (BPA 2014). Hence, this seaport has decided to reduce its dependency on LNG cargo by shifting to container-based cargo through improving its infrastructure and capacity, and developing new business with the economic corridor in Sabah and Sarawak (BPA 2014).

In general, the Asian region contributed 70.5% of 421.3 million TEUs in global container throughput in 2013 (Salisbury 2014), of which Malaysian container seaports contributed almost 17.7 million TEUs (4.2%) to world container trade. In total, Malaysia shared the third rank with Korea according to the volume of container trade contributed in the Asia

region, after China and Singapore, which led the ranking with 57% and 11% respectively in 2013 (Lavigne 2014). Table 4.2 shows the proportions of world container trade for the Asian region.

Based on its capacity, record of container throughput volume and profile in world rankings, Port Klang is the most important seaport in Malaysia, followed by PTP and Penang Port. The remaining seaports such as Johor Port, Kuantan Port and Bintulu Port have their own strengths by providing sufficient facilities for general cargo handling, bulk cargo and passenger terminals.

Table 4.2: Contribution of Asian seaports to world container trade in 2013

<i>Top Asian Seaports</i>	<i>TEUs (million)</i>	<i>Percentage</i>
<i>China</i>	<i>169</i>	<i>57</i>
<i>Singapore</i>	<i>33</i>	<i>11</i>
<i>Korea</i>	<i>17.7</i>	<i>6.0</i>
<i>Malaysia</i>	<i>17.7</i>	<i>6.0</i>
<i>Japan</i>	<i>16.4</i>	<i>5.6</i>
<i>Taiwan</i>	<i>10.0</i>	<i>3.4</i>
<i>Indonesia</i>	<i>9.2</i>	<i>3.1</i>
<i>Thailand</i>	<i>6.0</i>	<i>2.0</i>
<i>Vietnam</i>	<i>6.0</i>	<i>2.0</i>
<i>Sri-Lanka</i>	<i>4.3</i>	<i>1.4</i>
<i>India</i>	<i>4.0</i>	<i>1.3</i>
<i>Manila</i>	<i>3.8</i>	<i>1.2</i>
<i>Total</i>	<i>297.1</i>	<i>100</i>

Source: Adapted from Lavigne (2014)

Containers handled in Port Klang, PTP and Penang Port have increased dramatically since the 1990s. In 1990 the throughput recorded in Port Klang was 496,526 TEUs and increased to 10.9 million TEUs in 2014 (MOT 2015). Similarly, the volume of containers in PTP increased significantly from 20,698 TEUs in 1999 to 8.5 million TEUs in 2014 (MOT 2015).

Penang Port is the third container seaport. Its container throughput increased from 222,240 TEUs in 1999 to 1.26 million TEUs in 2014 (MOT 2015). Kuantan Port and Bintulu Port also exhibit similar changes but with a small margin compared to the abovementioned

three seaports. Figure 4.10 vindicates that Port Klang, PTP and Penang Port are Malaysia's dominant container terminals in terms of the volume of container throughput. Therefore, Port Klang, PTP and Penang Port are the seaports that are the focus for this study

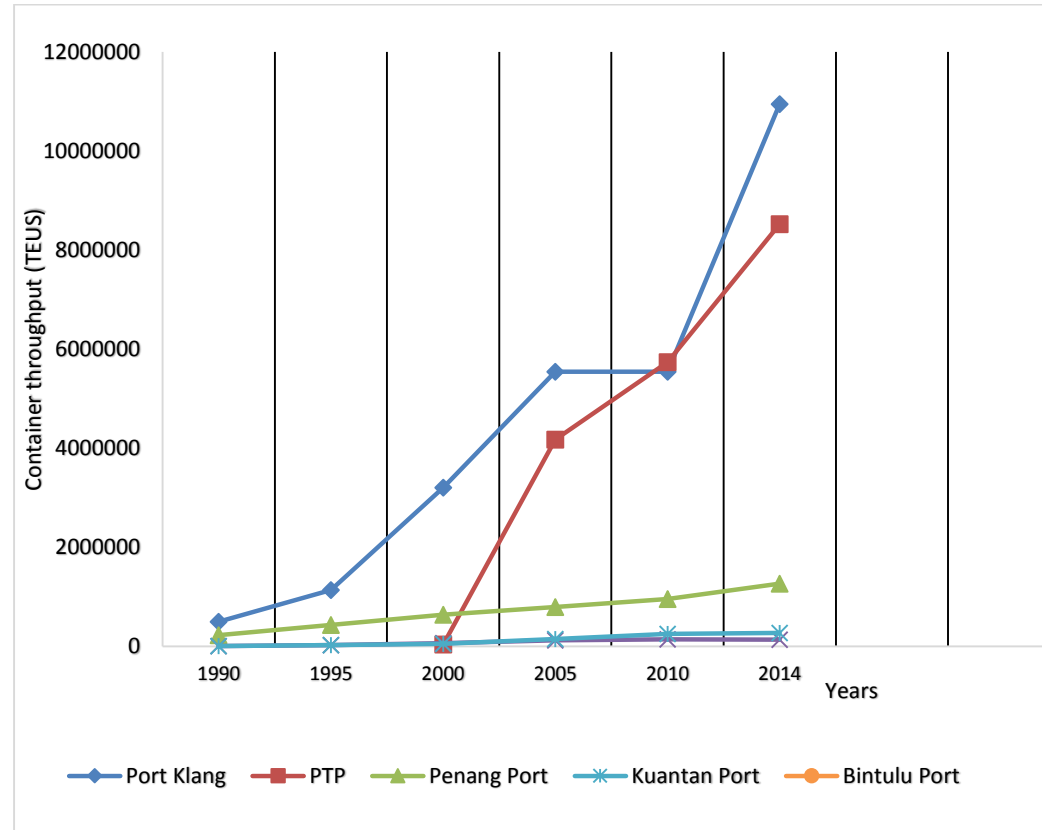


Figure 4.10: Trend of container throughput in Malaysian seaports 1990–2014
Sources: Adapted from MOT (2015)

4.5 Dry ports

The development of dry ports in Malaysia began in 1984 and there are four dry ports currently operated in peninsular Malaysia: Padang Besar Cargo Terminal (PBCT), Ipoh Cargo Terminal (ICT), Nilai Inland Port (NIP) and Segamat Inland Port (SIP) (Jeevan et al. 2015). Malaysian dry ports follow in the seaports' footsteps by providing an opportunity for the private sector to be involved as terminal operators. As a result, each dry port in Malaysia is operated by a different operator such as Multimodal Freight for PBCT, Ipoh Container Terminal for ICT, Guper Integrated Logistics for NIP and Segamat Inland Port for SIP. Malaysian dry ports are also governed by seaport authorities and state

governments. The combination of vertical ownership in dry port operations shows that the Public Private Partnership (PPP) has been used to develop Malaysian dry ports.

1. Padang Besar Cargo Terminal (PBCT)

PBCT started to operate in 1984 and is located at the southern tip of peninsular Malaysia. It was the first dry port in Malaysia but this terminal has the least capacity of all the dry ports (UNESCAP 2006). PBCT encourages crossborder transactions between Malaysia and Thailand. The strategic location of PBCT attracts more containers from southern Thailand to be shipped through Penang Port because this seaport is the nearest to the manufacturers in Thailand compared to Bangkok Port and Laem Chabang Port. This dry port contributes 40% of the containers to Penang Port and 10% to Port Klang (Jeevan et al. 2015).

Port Klang and Penang Port are the main shareholders for this dry port, with almost 90% of shares being from Penang Port and 10% from Port Klang. In general, PBCT is a border-based dry port or mid-range dry port for Penang Port and distant dry port for Port Klang. PBCT is referred to as a mid-range dry port because it is located between 50–150 kilometres from Penang Port and more than 150 kilometres in order to be classified as distant dry port to Port Klang (Roso et al. 2009). PBCT serves domestic and international manufacturers that operate close to the Malaysia-Thailand border.

The capacity of the container yard in PBCT is around 800 TEUs and unfortunately this dry port has no space for locating empty containers or land for future development. Perishable goods, rubber, wood, timber and raw materials are the main cargo handled in PBCT.

2. Ipoh Cargo Terminal (ICT)

ICT is the second dry port in Malaysia which was established in 1989 and is well connected to Penang Port, Port Klang and PTP (ICT 2015). ICT is the only dry port in Malaysia which is connected to all three major container seaports in Malaysia. This dry port is located in the northern region of peninsular Malaysia and generates 35% of containers to Port Klang, 10% to Penang Port and 5% to PTP (Jeevan et al. 2015). In general, ICT is a city-based dry port or mid-range dry port for Penang Port and distant dry port for PTP and Port Klang. For ICT, Port Klang, PTP and Penang Port are the main clients but at the same time it offers services for domestic customers from the northern and central regions of peninsular Malaysia.

In ICT, the shareholders are mainly from seaports, the state government and a railway operator. For example, 45% of shares are from Port Klang, Penang Port and Johor Port. On the other hand, the state government and Malaysian Railway contribute almost 55% of the shares in this dry port. In terms of space availability, this dry port has a capacity of 800 TEUs in its container yard and space availability to accommodate empty containers, but it has no land for future development. The main cargo handled in this dry port are raw materials and manufacturing goods.

3. Nilai Inland Port (NIP)

NIP is the third dry port in Malaysia. This dry port started operations in 1995 and is located in the central region of peninsular Malaysia (UNESCAP 2006). NIP contributes 60% of containers to Port Klang and 10% to PTP (Jeevan et al. 2015). This volume of containers to seaports makes NIP the highest generator of containers to seaports among all Malaysian dry ports. NIP is a city-based dry port because it is located near to the cities of Seremban and Kuala Lumpur. From the seaport perspective, NIP is considered a short-range dry port for Port Klang because it located less than 50 kilometres from this seaport.

It is categorised as a distant dry port for PTP. NIP offers services to Port Klang as main clients and other stakeholders such as manufacturers from Seremban city, Selangor and Kuala Lumpur.

Shareholders in this dry port consist of state government, logistic companies and Port Klang. Current yard capacity of this dry port is about 1,200 TEUs but it has no space for empty containers. For future development, this dry port possesses land to accommodate additional containers in the future. The main cargo handled in this dry port include raw materials and manufacturing goods.

4. Segamat Inland Port (SIP)

SIP is the newest and the largest dry port in Malaysia, located in the southern region of peninsular Malaysia. It started operations in 1998. SIP provides facilities and services to manufacturers and traders in southern Malaysia and Singapore (SIP 2015). Although SIP is the largest dry port in Malaysia, it only produces 10% of containers to Port Klang and the same percentage to PTP (Jeevan et al. 2015). SIP is considered a border-based dry port which creates a trade connection between Malaysia and Singapore. SIP is also considered a mid-range dry port for Port Klang and PTP.

The main shareholders in this dry port are Malaysian railway, Johor Port, Port Klang and the state government. The total capacity of SIP's container yard is 3,500 TEUs and it has ample of space for empty containers and for future development. The main cargo handled in SIP are agricultural products and raw materials. Table 4.3 summarises the information on Malaysian dry ports.

Table 4.3: General information on Malaysian dry ports

Dry Ports	PBCT	ICT	NIP	SIP
Operators	Multimodal freight Pvt . Ltd.	Ipoh Container terminal	Guper integrated logistics Pt. Ltd.	Segamat Inland Port
Ownership	PPP	PPP	PPP	PPP
Share holders	90 % Penang Port 10 % Port Klang	15% Port Klang 15% Johor Port 15 % Penang port 25% State government 30% Malaysian railway	30% State government 55 % Complete Logistics 15% Port Klang	25% Malaysian railway 25% Johor Port 25% Port Klang 25% State government
Location	Border-based	City-based	City-based	Border-based
Distant	Mid-range to Penang Port Distant to Port Klang	Mid-range to Penang Port Distant to Port Klang and PTP	Short-range to Port Klang Distant to PTP	Mid-range to Port Klang and PTP
Seaport connection	Penang port Port Klang	Penang Port Port Klang PTP	Port Klang PTP	Port Klang PTP
Stakeholders	Forwarding agents Shippers Port Klang Penang Port Railway Hauliers	Freight forwarders Shippers Malaysian railway Port Klang Johor port Penang Port	Manufacturer Forwarding agents Shippers Port klang Johor port Hauliers	Johor Port Port Klang Malaysian Railway Forwarding agents Shippers Hauliers
Container to seaports (%)	40% to Penang port 10% to Port Klang	35 % to Port Klang 10 % to Penang port 5 % to PTP	60 % to Port Klang 10 % to PTP	10% to PTP 10% to Port Klang
Transport connection	Rail Road	Rail Road	Road	Rail Road
Capacity of container yard	800TEUs	800TEUs	1,200TEUs	3,500 TEUs
Space for empty container	None	Available	None	Available
Type of cargo	Perishable goods Rubber Timber	Raw materials Manufacturing goods	Raw materials Manufacturing goods	Agricultural product Raw material
Land for future development	None	None	Available	Available

Source: Adapted from UNESCAP (2006); Jeevan et al. (2015)

4.6 Multimodal transportation

The connectivity and coordination between seaports, dry ports and other stakeholders through multimodal transportation plays an integral role in enhancing the efficiency of container distribution, especially in inland areas (Horst & Langen 2008).

Currently PBCT, ICT and SIP are linked to seaports through road and railway systems, and NIP operates in a single mode of transportation, i.e. road. Each dry port is interconnected with the others either via road or rail to ease the container distribution process from the north to south peninsular and vice versa.

Basically multimodal transportation is defined as ‘an optimal integration of different transport modes enabling an efficient and cost-effective use of the transport system through seamless and customer-oriented door-to-door services (European Commission 2000, p. 2). In short, it ‘means the carriage of goods by at least two different modes of transport’ whereby intermodal refers to the connection between modes of transportation (Kanafani & Wang 2010, p. 4). In Malaysia, multimodal transportation exists through road and rail and these types of transportation are the dominant modes used in the trade system, influencing the growth of seaports by integrating the land use and road network systems (Anor et al. 2012).

4.6.1 Road networks

The major mode of transportation in Malaysia is by road. The road system covers about 210,658 kilometres and almost 79% of the road is paved with flexible or rigid pavement (PWD 2014). In general, highway roads are broader than expressways and they have no intersections or overpasses (PWD 2014). About 1,969 kilometres of the total length of the road system is highway, managed by the Malaysian Highway Authority. The North-South Expressway is the Malaysia’s longest route which extends more than 700 kilometres between the Thailand border and Singapore (Chuen et al. 2014). State road systems cover

about 61,420 kilometres in length and connect villages or rural areas within the state (PWD 2014).

The states of Penang, Kuala Lumpur, Klang and Johor are considered metropolitan areas (Zawawi et al. 2016). They share a common identity as the most congested states in Malaysia because of their high population and economic development (PWD 2014). Almost 80% of the Malaysian road system usage is for freight logistic purposes and 20% for passenger transportation (Masriq 2012). In 2012, almost 1.03 million vehicles were used for freight distribution whereby 166,576 vehicles were used for general purposes (MOT 2013). These statistics show that the Malaysian road system plays a vital role in the freight task.

All main seaports, and dry ports along the freight corridors, are connected to one another through the inter- and intra-city road network. In general, the intra-city road network is road connectivity within the state, while the inter-city network is in the form of expressways between states (Abdul et al. 2008). The North-South Expressway (NSE) is the longest expressway in Malaysia, connecting all the states on the west coast of peninsular Malaysia. NSE starts from Bukit Kayu Hitam, a town on the Malaysia-Thailand border in the north, and ends in Johor Bharu in southern peninsular Malaysia, with its total length being 772 kilometres (PLUS 2011).

There are additional expressways adjoining the NSE network such as Butterworth-Kulim Expressway (BKE), Federal Highway Routes, Klang Valley Expressway (NKVE), the North-South Expressway Central Link (NSECL) and Seremban-Port Dickson Highway (SPDH). The total length of inter-city expressway connection is 926 kilometres and the entire expressway operations, maintenance and ancillary services are provided by PLUS Malaysia. The information on Malaysian expressways is summarised in Table 4.4.

Table 4.4: Information on Malaysian expressways connections

Expressways	Connection	Kilometres
North-South Expressway (NSE)	Connecting the border of Thailand in the north to the border of Singapore in the south	772
Klang-Valley Expressway (NKVE)	Connecting Kuala Lumpur and the North Klang industrial and urban area	35
Federal-Highway Route	Connecting the industrial and urban areas of Subang and Klang	16
Seremban-Port Dickson Highway (SPDH)	Connecting Seremban and Port Dickson	23
The North-South Expressway Central Link (NSECL)	Linking South and North of Kuala Lumpur to the KL International Airport.	63
Butterworth-Kulim Expressway (BKE)	Linking Kulim in Kedah to Seberang Perai in Penang.	17
Total Length		926

Source: Adapted from PLUS (2011)

Although most of the cities are connected via expressways, the problems presented by the intra-city road system such as narrow road width, congestion, overuse and the behaviour of the road users create difficulties in freight transportation for major seaports. For example, in Penang Port, high traffic volume and congestion in the city centre, narrow road widths and many one-way routes cause constraints during road freight transportation (Chen et al. 2015). The behaviour of haulage drivers skipping the bypass highway and using the main state roads to avoid toll payments worsens the congestion in Port Klang (Chen et al. 2015).

In PTP, the quality of the connection is impacted on by overuse and damaged infrastructure and facilities, such as roads, flyovers, road dividers and traffic lights, caused by the heavy load of freight vehicles. The state government is unable to carry out upgrading works due to the heavy congestion in the city (Chen et al. 2015). Although the development of expressways provides effective freight transportation between states, the road connection within the states is not sufficient to provide efficiency in the network.

4.6.2 Rail networks

Containerisation in Malaysia started in 1972 and, a year later, container transportation by rail began (Valautham 2007). In 1973, the total amount of containers transported by rail was 974 TEUs, however the volume started to increase significantly, for example from 105,300 TEUs in 1991 to 343,395 TEUs

in 2013 (MOT 2014). Figure 4.11 summarises the trend of total TEUs transported by rail from 1973 until 2013. Of notice is that the volume of containers transported by rail dropped dramatically in 2001 and 2008 due to the global economic recession. However, the trend of containers being transported by rail has gradually increased from 266,722 TEUs in 2009 to 343,395 TEUs in 2013 (MOT 2014).

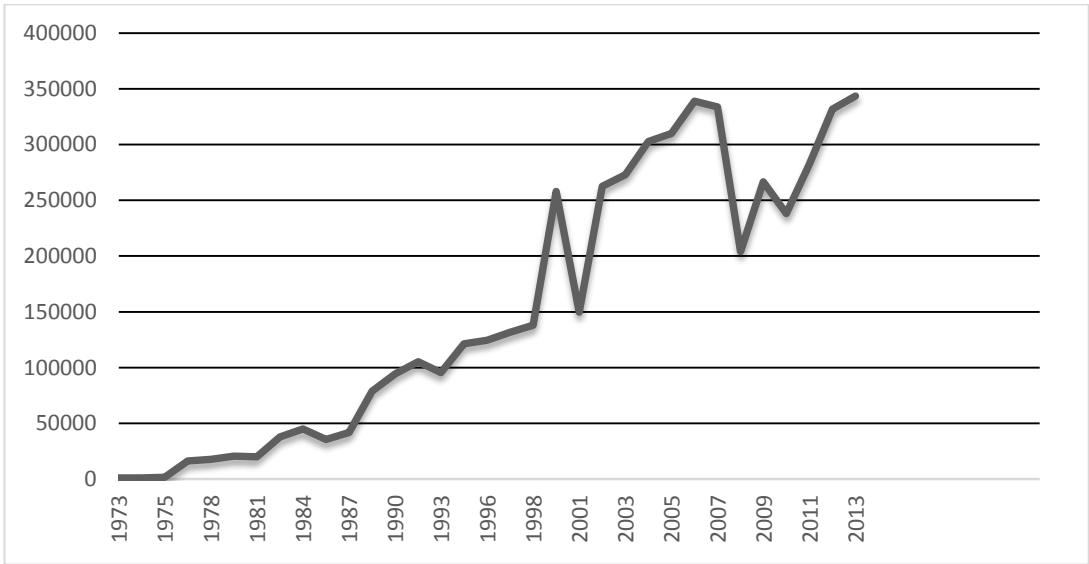


Figure 4.11: Rail freight trend 1973–2012 (TEUs)
Sources: Adapted from MOT (2014)

The Malaysian rail network covers all major container seaports, and some dry ports utilise the rail network as one of the main modes of transportation to reduce congestion and increase seaport efficiency. Malaysian railway has developed haulage transportation by forming a road haulage company known as Multimodal Freight to provide door-to-door services to the clients (Valautham 2007). The intention to introduce a haulier service is to proceed with a just-in-sequence (JIS) freight transportation system. It emphasises how keen Malaysian railway systems are to provide effective services to the clients. Figure 4.12 shows the routes of Malaysian expressways, rail links and the most congested areas in peninsular Malaysia.

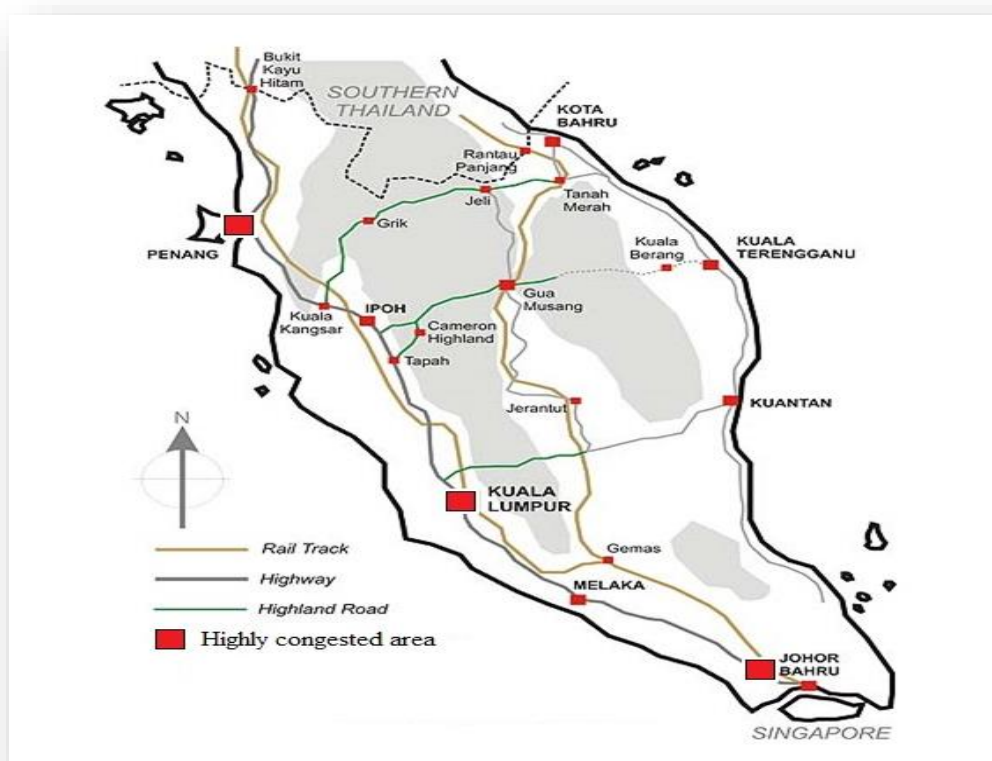


Figure 4.12: Malaysian expressway and railway link
Source: Adapted from PWD (2014)

In general terms, the total length of Malaysia's railway track is 1,641 kilometres, of which 80% is single track and 20% double track, connecting from the border of Thailand in the north to Singapore in south peninsular Malaysia with a maximum speed of 70 kilometres per hour (Naidu 2008). As almost 90% of the rail track is narrow gauge, the infrastructure of Malaysian rail freight needs further development to meet the freight demand (Malaysia Freight Transport 2012). The inter-urban rail connectivity does not cover all towns and cities and therefore the shippers/manufacturers must overly depend on road freight (Roza et al. 2013). Moreover, the capacity of the train service is only able to carry 60 TEUs per trip which is lower than the world average of 66 TEUs per trip (Woodburn 2011).

Although the existing Malaysian rail network connects container seaports and hinterlands, it is not fully utilised. This is evidenced by containers having only a low share of rail freight, about 2% (Table 4.5). The number of containers shipped by rail in 2013 was 343,395 TEUs, slightly increased from 302,736 TEUs in 2004, but the percentage of the total container freight decreased to 1.6% in 2013

from 2.7% in 2004. The extreme imbalance of modal split in land freight transport creates challenges for seaports–dry ports–hinterland freight transportation.

Table 4.5 Containers freight by rail and road between 2004 and 2013

Years	Rail (TEUs)	%	Road (TEUs)	%	Total (TEUs)
2004	302,736	2.7	11,038,535	97.3	11,341,271
2005	310,011	2.6	11,735,902	97.4	12,045,913
2006	339,037	2.5	13,129,611	97.5	13,468,648
2007	333,688	2.2	14,837,208	97.8	15,170,896
2008	203,939	1.3	16,072,493	98.7	16,276,432
2009	266,722	1.7	15,592,424	98.3	15,859,146
2010	238,251	1.3	17,935,543	98.7	18,173,794
2011	282,352	1.4	19,696,354	98.6	19,978,706
2012	331,870	1.6	20,224,855	98.4	20,556,725
2013	343,395	1.6	20,532,923	98.4	20,876,318

Source: Adapted from Chen et al. (2015)

Malaysia has rail links connecting to other nations including Thailand, Singapore and other countries in Southeast Asia. This inter-regional rail network consists of the Malaysia-Thailand Landbridge (MTL) and Singapore-Kunming Rail Link (SKRL). MTL is already operating and SKRL link is still at the development stage.

4.6.2.1 Malaysia-Thailand Landbridge (MTL)

The landbridge between Malaysia and Thailand started to operate in 1999 as a strategy for both countries to increase freight revenues which had been reduced after the impact of the Asian financial recession in 1997 (Valautham 2007). This landbridge train service is a joint traffic agreement between Malaysian Railway and State Railway of Thailand to facilitate the free flow of containers or cargo between the two regions (Valautham 2007). The landbridge connection provides transportation services for container transport from Port Klang to Bangkok.

In facilitating the transport of containers from Malaysia to Bangkok and vice versa, the landbridge plays a critical role. This international intermodal transportation involves Malaysian seaports Port Klang and Penang Port, dry ports ICT and PBCT, and Thailand’s seaports including Bangkok seaport and Laem Chabang seaport via Lat Krabang Inland Container Depot (LKICD) at the border.

This landbridge service manages to generate sufficient container volume especially to major Malaysian container seaports. Some significant benefits have evolved from the rail network collaboration between Malaysia and Thailand, such as time accuracy in delivery, simple documentation procedure, and lower cost of transportation per unit due to the applicability of economies of scale (Valautham 2007).

4.6.2.2. Singapore-Kunming Rail Link (SKRL)

Singapore-Kunming Rail Link is a flagship project to establish the ASEAN rail transportation network. This network will start from Singapore, proceed via Malaysia and will connect most of the main cities in Southeast Asia such as those in Cambodia, Laos, Myanmar, Thailand and Vietnam. It will finally end at Kunming in China (ASEAN 2011). The total length of SKRL is 7,000 kilometres and it will start operation in 2021 (Ngoc 2011). However, the rail link for freight transportation in Singapore is still not completed because of high dependency on shipping network and the preference has been given for passenger transportation (ASEAN 2015). The SKRL will enhance container distribution opportunities for Malaysian container seaports and dry ports and at the same time create a new dimension to the maritime container distribution network in this region because the objective of SKRL is to provide efficient goods transportation within the sub-region and beyond (Ngoc 2011). The SKRL project has huge potential to facilitate trade development and transportation connection by extending the current landbridge facilities which currently only connect Malaysia and Thailand.

The rail connection beyond the region has been well established and improves the connection in the multimodal transportation system especially between Asia and Europe. For example, the development of an inter-regional rail network has been implemented between China and Poland through China-Europe Rail Link. This rail network collects containers from China and transports them by rail to Poland via dedicated dry ports in each country and vice-versa. This intra-regional

network between two continents provides cost-effective services and only consumes half the time of sea freight (Knowler 2014). As Malaysia was ranked as the world 4th in terms of the total container seaport throughput after China, Singapore and Korea in 2014 (UNCTAD 2015), the SKRL link holds great promise in contributing to Malaysian container seaports, especially in utilising existing infrastructure in the freight network for effective container transportation.

In the future, Malaysia potentially is exposed to Europe by the implementation of Trans-Asia Railway Network. TAR rail network is a United Nations project to link the Far East to Western Europe via Southeast Asia, Northeast Asia, Central Asia and South Asia with total length of 117,500 kilometres and serving 28 countries (UNESCAP 2013). From Malaysia's point of view, the TAR network has the potential to facilitate coastal transportation development. Moreover, the existence of dry ports in Malaysia provides an opportunity for equal proportions of different modes of transportation, providing potential benefits in terms of both cost and time.

4.7 Mapping the Malaysian container seaport system

Based on the discussion in previous sections, this section summarises Malaysian container seaport systems in terms of the three main container seaports included in this research. Table 4.6 presents an overview of Malaysian container seaport systems, including the regions within the main freight corridors served by container seaports and how the intermodal nodes are linked.

Penang Port mainly serves the northern freight corridor including NCER, ECER and IMT-GT, which consists of eight main hinterlands. All these hinterlands are located at distant ranging from 4 kilometres to 315 kilometres from Penang Port. The average local container freight generated through this freight corridor is around 1,166 TEUs every month (MOT 2012).

All hinterlands in this freight corridor are connected through the landbridge MTL and road networks. However, out of the eight hinterlands, Padang Besar and

Hatyai are connected through road and rail and the remaining are only linked via the road network. Penang Port is connected to several inland freight facilities including two dry ports, PBCT and ICT, and the two inland clearance depots Bukit Kayu Hitam and Prai Inland Clearance Depot.

However, the landbridge service is rarely used in Thailand's provinces because the majority of the containers are being transported by truck to PBCT at the Malaysian border, and less so by rail freight from Thailand. Poor condition of locomotives and low frequency of service operations that was limited to two trips per month have caused the rail traffic collaboration between two countries is not fully utilised and has resulted in an unbalanced proportion in transportation mode in the border region of Malaysia-Thailand (UNESCAP 2012).

Port Klang serves the central freight corridor covering NCER, ECER and IMT-GT with eight major hinterlands. The distance between the hinterlands and Port Klang range from 4 kilometres to 538 kilometres. According to MOT (2012), the average amount of local container freight generated through this freight corridor was around 9,934 TEUs every month.

The connection between Port Klang and its hinterlands is dominated by road than rail network. Four of the hinterlands including Kapar, Kuantan, Bukit Jalil and Shah Alam are connected through road networks and the remaining hinterlands are linked through road and rail. All four dry ports, located at distance ranging from 1 kilometre to 172 kilometres, are connected to Port Klang's hinterlands. In addition, there are several inland clearance depots including Sungai Way and Bukit Kayu Hitam also linking these hinterlands through road networks.

Table 4.6 An overview of freight corridors in Malaysian container seaport systems

Seaports	Freight corridors and regions	Hinterlands in the freight corridor	Distance to seaport (Km)	Duration (Hrs) to seaport by road	Duration (Hrs) to seaport by rail	Train services	Availability of dry ports & inland depot		
							Dry ports & depot	Distance (Km)	Connectivity
Penang Port	Northern Freight Corridor: • NCER • ECER • IMT-GT Average local TEUs per month: 1,166.	Bukit Kayu Hitam	135	1hrs 45mins	NA	NA	PBCT	23	Road
		Padang Besar	166	2hrs 05mins	5hrs 16mins	6 trips/ day	BKH-ICD	3	Road
		Hatyai, Thailand	238	4hrs	6hrs 39mins	2 trains/ week	PBCT	1	MTL & Road
							BKH-ICD	32	Road
		Pengkalan Kubor	315	4hrs 49mins	No rail link	NA	PBCT	56	MTL & Road
							BKH-ICD	59	Road
		Prai	17.3	Less than 45 mins	NA	NA	PBCT	417	Road
							BKH-ICD	385	Road
		Mak Mandin	4.0	Less than 15 mins	NA	NA	ICT	138	Rail & Road
							Prai-ICD	13	Road
Port Klang	Central Freight Corridor: • NCER • ECER • IMT-GT Average local TEUs per month: 9,934.	Kapar	24.3	1hrs	NA	NA	ICT	145	Rail & Road
							Prai-ICD	8	Road
		Kuantan	276	3hrs	NA	NA	ICT	164	Rail & Road
							Prai-ICD	35	Road
		Bukit Jalil	4.5	Less than 1 hr	NA	NA	ICT	148	Rail & Road
							Prai-ICD	29	Road
		Shah Alam	24.2	1hr	NA	NA	NIP	78	Road
							SW-ICD	35	Road
		Selayang	64.6	1hr 15mins	4.7hrs	6 trips /2 day	SIP	172	Rail & Road
							SW-ICD	248	Road
PTP	Southern Freight Corridor: • IM • IMS-GT Average local TEUs per month: 7,494	Hatyai, Thailand	476	6hrs 14mins	13hrs	2 trains/ week	NIP	38	Road
							SW-ICD	14	Road
		Subang	32.7	Less than 1hr	2.4hrs	6 trips / day	NIP	52	Road
							SW-ICD	12	Road
		Padang Besar	538	5hrs 45mins	11hrs 30mins	2 trips/week	NIP	63	Road
							SW-ICD	30	Road
							PBCT	56	MTL & Road
							BKH-ICD	59	Road
							NIP	63	Road
							SW-ICD	10	Road
							PBCT	1	MTL & Road
							BKH-ICD	32	Road
		Pasir Gudang	43.5	2hrs	3hrs	6 trips/day	SIP	190	Rail & Road
		Nusajaya Tech Park	10.4	Less than 1 hr	NA	NA	SIP	177	Rail & Road
		Jurong, Singapore	22	2.5hrs	NA	NA	SIP	197	Road
		Tanjung Langsat	56.7	2.5hrs	NA	NA	SIP	209	Rail & Road
		Air Keroh, Malacca	212	3.5hrs	NA	NA	NIP	98	Road
							SIP	87	Road
							ICT	350	Road

PTP serves the southern freight corridor covering five major hinterlands from IM and IMS-GT. The average local container freight generated through this freight corridor was around 7,499 TEUs every month (MOT 2012). There are domestic and international manufacturers operating businesses in these hinterlands. The distant of these hinterlands to PTP ranges from 10 kilometres to 212 kilometres. Moreover, four out of the five hinterlands are connected through road link to PTP except Pasir Gudang which has both road and rail networks.

From the perspective of inland freight facility, PTP is assisted by three dry ports including ICT, NIP and SIP, located at distant ranging from 87 kilometres to 350 kilometres to the hinterlands. All these dry ports are connected to PTP via road and rail except NIP which only uses road link.

PTP is connected to Singapore via the North-South Highway Link and Malaysia-Singapore Second Link respectively (PTP 2014). However, the quality of the connection is impacted on by overuse, and damaged infrastructure and facilities, such as roads, flyovers, road dividers and traffic lights, caused by the heavy load of freight vehicles. The state government is unable to carry out upgrading works due to the heavy congestion in the city. These problems are affecting the freight movement between these countries.

Incomplete freight rail connection between Singapore and Malaysia and the frequency of rail freight between Malaysia and Thailand is very low. This gap has a great impact on the inland trade network between these three nations. According to MITI (2013), Singapore and Thailand are the top two trading partners for Malaysia, upgrading rail infrastructure and utilising the landbridge rail system to connect Thailand–Malaysia–Singapore so as to improve intermodal freight transportation across the border will bring substantial economic benefits for Malaysia. National plans to prioritise rail transportation

development, improvement in road quality and improving capacity in freight facilities needs to be streamlined as a main agenda in the government plan entitled the Malaysian Plan. In addition, simplifying trade procedures such as customs clearance at the inland borders with Thailand and Singapore will contribute to the connectivity in terms of time and cost benefits.

Figure 4.13 shows the holistic view of Malaysian container seaport systems consisting of container seaports, dry ports, freight corridors, and multimodal transportation. In comparison, the central region of peninsular Malaysia is more active in contributing container freight compared to that in northern and southern regions. However, the eastern region recorded very low local volume with around 136 TEUs on average every month (MOT 2012). The abovementioned phenomenon indicated that the Malaysian seaport system is more active on the west coast compared to the east coast. Moreover, unavailability of inland freight facilities, limited multimodal transport network, and uneven regional development were some of the reasons for the existing situation in east coast peninsular Malaysia (Naidu 2008).

There are some constraints in the components of Malaysian container seaport systems, for example, poor road accessibility to seaports, limited transportation mode in the dry ports, uneven development in the east coast freight corridor and unbalanced freight transportation options between road and rail.

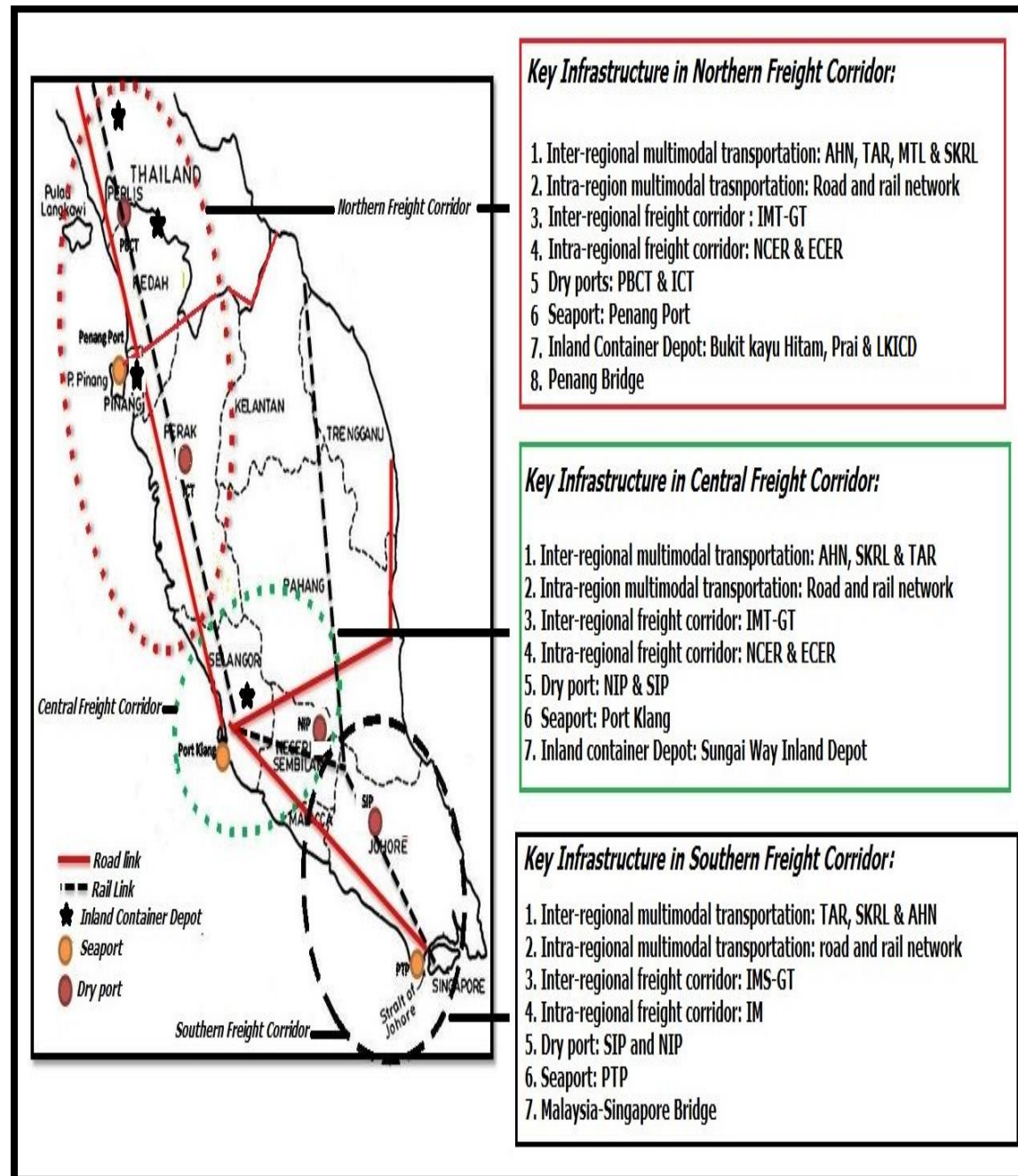


Figure 4.13 Malaysian container seaport systems
Source: Adapted from Nasir (2014)

Although freight corridors are supported by the government economic development plan in each region, the efficiency of inland freight distribution has been affected due to the abovementioned deficiencies. The literature shows that the strategy to utilise inland freight facilities especially dry ports in fact is able to strengthen or improve the efficiency of other components in the system. These include the improvement in multimodal transportation

(Woxenius et al. 2004) and effectiveness of freight corridors(Rodrigue & Notteboom 2009); facilitating the coordination among the components in the container system (Horst & Langen 2008) and, finally, enhancing the competitiveness of seaports(Notteboom & Winkelmanns 2001).

4.8 Summary

This chapter provided an overview of the Malaysia container system in terms of four main components: seaports, dry ports, freight corridors and multimodal transportation. In Malaysia, there are three main seaports that dominate container freight, namely Penang Port, Port Klang and PTP. These seaports are supported by four main dry ports: PBCT to Penang Port and Port Klang; ICT to all seaports; NIP to Port Klang and PTP and, finally, SIP assists Port Klang and PTP.

All seaports and dry ports are exposed to major freight corridors in peninsular Malaysia such as the northern, central, southern and east coast freight corridors. Among these freight corridors, central is the most productive while the east coast freight corridor is the least productive compared to others. In addition to intra-region freight corridors, Malaysian seaports are connected to inter-region freight corridors including IMT-GT in the north and IMS-GT in south peninsular Malaysia. Road and rail networks are the main multimodal transportation. Road networks cover all regions, seaports and dry ports in peninsular Malaysia. On the other hand, rail networks cover all these seaports and dry ports except NIP and mainly cover the west coast region. MTL and SKRL play a crucial role by linking Thailand–Malaysia–Singapore in freight transportation.

However, unbalanced economic planning on the east cost of peninsular Malaysia, and in some areas in the northern and southern regions, has caused some of the potential in the

Malaysian container seaport system to remain underutilised. Therefore, all components in the freight system are required to well integrate through dry ports in order to open a new paradigm for the Malaysian container system to use, utilise and manage these opportunities for current and future development.

The review conducted in this chapter has shown that dry ports are important nodes in Malaysian container seaport systems. It is necessary to discover the opportunities from government economic development plans for dry port operations and further development. Moreover, it is essential to explore how Malaysian dry port operations can be enhanced to utilise opportunities for further development as well as to improve the efficiency of the container seaport system. The following chapter discusses the methodology of the empirical study on Malaysian dry ports.

CHAPTER FIVE

RESEARCH

METHODOLOGY

5.1 Introduction

The objective of this chapter is to present the design and methodology of the research. A conceptual framework for this research is generated based on the outcome of the literature review from Chapter Two, Three and Four. It addresses the main concepts, factors or variables to be studied in this research. The outcome of this chapter will help the researcher develop interview and survey questions for the empirical study in Malaysia is to be designed to identify influencing factors for dry port operations and impacts of dry ports on seaport competitiveness.

It continues with the research philosophy and logical position to describe the flow of the research, followed by an introduction on the research purpose to determine the specific research methodology applied in this research. The research question and research objective are highlighted to explain the main aim of this thesis. The research units of analysis are identified to determine appropriate information for answering the research questions. The chapter then continues with a discussion on the mixed method design and justification of the methods selected and applied in this research.

Data collection and analysis are divided into two main phases: the qualitative phase and the quantitative phase. In each phase, there are in-depth explanations about the sampling strategy, questionnaire design and pretesting, administration of data collection, the data analysis process and the evaluating of the validity and reliability of the data. Explanations are provided with regard to research ethics that are compulsory to consider before data collection. Finally, bias management and error control strategies have been implemented to ensure the quality and authenticity of the research.

5.2 The conceptual framework of the research

A conceptual framework identifies key concepts and variables in approaching research (Ravitch & Riggan 2012). It is important to explore a general view of the role of a dry port, operational influencing factors and impacts for seaport competitiveness to ensure the effectiveness of this intermodal terminal in the container seaport system, and to address the research questions in this research.

Changes in trade environment consisting of global production and trade systems, supply chain systems and logistics and transport systems forces seaports to be agile and flexible in responding to customer demand (Notteboom 2000; Cetin & Cerit 2010). Container seaport systems consist of four major components; container seaports, inland freight facilities, freight corridors and multimodal transportation (Rodrigue 2004; Bichou & Gray 2004; Notteboom & Rodrigue 2005; Jugovic et al. 2011). A dry port functions as an inland freight facility, and becomes important in assisting seaports in adjusting to changes in the trade environment and enhancing the competitiveness of the container seaports.

The role and functionalities of dry ports are utilised to assist the seaport in the container seaport system. Furthermore, influencing factors of dry port operations are identified to initiate suitable policy and strategy for enhancing a dry port's competency, which is expected to contribute positively to seaport competitiveness. The impacts of dry ports on container seaport competitiveness encourage an effective integration between the components in the container seaport system (see Figure 5.1).

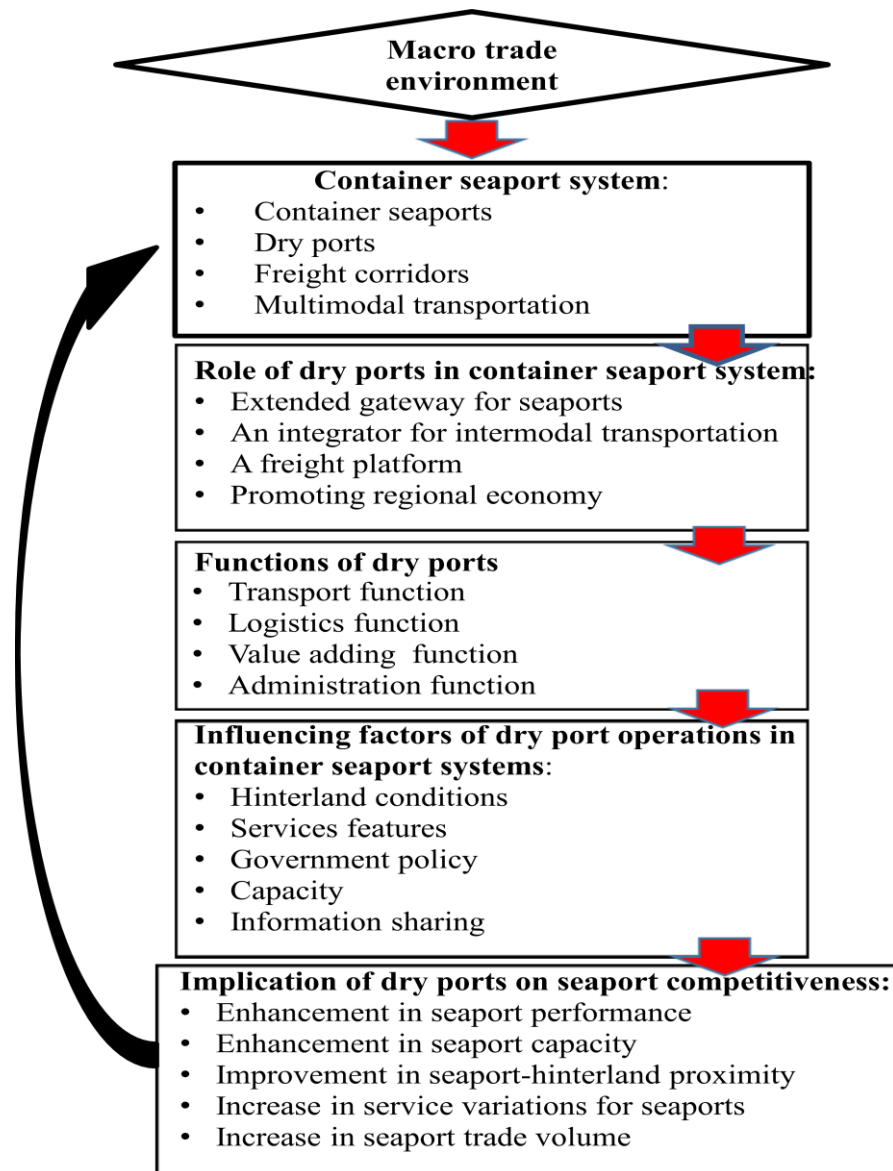


Figure 5.1: Conceptual framework of the research

5.3 Research philosophy and approach

Research philosophies or paradigms guide how researchers undertake their research such as deciding the research approach, research strategy, and research method for data collection and analysis. In other words, a research paradigm is fundamental to the process of research in all areas (Saunders et al. 2009); it is a set of basic beliefs that describes the nature of the world and the individual's place within it and it guides action (Denzin et al.

2006). There are four main research philosophies labelled: post-positivism, constructivism, participatory and pragmatism (Creswell & Clark 2011).

Post-positivism is described as quantitative research and intends to solve problems and discover causal relationships through statistical analysis (Kim et al. 2003). This philosophy focuses on theory verification, empirical observation and measurement, reductionism. Constructivism does not focus on numerical data but concentrates on phenomena, language, experiences and perception. The participatory research philosophy is normally associated with qualitative research and its emphasis is on collaboration, political orientation and empowerment issues (Creswell & Clark 2011). Pragmatism is not restricted to these philosophies and views of reality; it is problem-centred and focuses on pluralistic standpoints, real-world practices and the consequences of actions. Pragmatism is highly compatible with mixed methods research (Blaikie 2014).

Inductive research and deductive research are two main logical approaches in research (Saunders et al. 2009). Inductive research aims for theory development and involves the construction and explanation of models or theories, whereas deductive research involves testing the theoretical and conceptual framework through empirical studies (Vause 2006).

A research approach depends on the nature of the research purpose which can be classified as exploratory, descriptive and explanatory (Creswell 2009). Exploratory research is carried out when a phenomenon is little understood and there is very limited research on it. Meanwhile, descriptive research is conducted to describe the features of the variables of interest in a situation, and to portray the profile of a situation (Sekaran & Bougie 2010). An explanatory approach is used to establish the relationship between variables (Saunders et al. 2009).

This research has a combination of exploratory and explanatory purposes, taking both inductive and deductive approaches. Firstly, it is exploratory-based, because there are limited studies for determining the role of Malaysian dry ports and the challenges that they face in the seaport system. Limited research has been conducted to identify and address strategies to overcome these challenges in dry port operations. An inductive approach is suitable for exploring this particular issue via a qualitative approach, which falls under the philosophy of constructivism.

Secondly, a deductive approach is required to address the important factors that influence dry port operations in the container seaport system. Explanatory research is required because it establishes the relationship between dry ports and the competitiveness of container seaports. The relationship of dry ports' and container seaports' competitiveness is addressed in the quantitative phase which falls under the philosophy of post-positivism.

Underpinned by the research philosophy of pragmatism and the combination of inductive and deductive approaches, this research employs a mixed methodology, combining qualitative and quantitative methods as the research strategy. A qualitative method provides better understanding about the inner experience of participants, explores areas not yet thoroughly researched, discovers relevant variables that can be used in the quantitative method and offers a comprehensive approach to studying the phenomena (Corbin & Strauss 2014).

The qualitative approach overcomes limitations in the literature on the role, challenges and strategy of dry port development in container seaport systems. The quantitative approach validates results from the qualitative method, and analyses the influencing factors of Malaysian dry port operations, determining the impact of dry ports on seaport competitiveness. The philosophy of pragmatism needs to be applied in this research to

utilise its attributes, namely the use of pluralistic standpoints, suitability in real world practice, and consequences of actions.

5.4 Research design

Research design is a procedure of data collection, analysis, interpretation and reporting the data in the research (Creswell & Clark 2007). It is the plan and procedure for research to be conducted based on the nature of the research problem which is addressed in the research (Creswell & Amanda 2008). The selection of research design depends on availability of resources, philosophy for the research, research questions and objectives (Sounders et al. 2009). As indicated in Section 5.3, this research chooses a mixed methodology as the research strategy. This section discusses the research design of mixed methods. Commencing with a discussion on mixed method research, it explains research questions development, research unit of analysis and the exploratory mixed method design. Detailed data collection approaches including qualitative and quantitative data collection and analysis will be discussed in Sections 5.5 and 5.6 subsequently.

5.4.1 Mixed methods

Mixed method research combines elements of qualitative and quantitative research approaches during data collection, analysis and inference for the broad purposes of breadth and depth of understanding and corroboration (Johnson et al. 2007, p. 123). The effectiveness is the main source of rationalisation for mixed method research because the output will be greater than mono method studies (Onwuegbuzie & Leech 2004). The combination of insights and procedures from two different paradigms provides a more productive and workable solution to produce a superior product (Johnson & Onwuegbuzie 2004). It provides separate interpretations on identifiable qualitative and quantitative data, and mixes the output more coherently and comprehensively than a mono method

(Tashakkori & Creswell 2007). The features of a mixed method strategy are compatible with addressing the research purpose and research questions in this research.

There are many gaps in the literature with regard to the role, challenges and strategy for Malaysian dry port development, factors that influence dry port operations vital to seaport competitiveness, and the lack of qualitative and quantitative research in Malaysian dry ports. These require a qualitative approach to explore them and validate outcomes at the quantitative phase. Adopting pragmatism as a philosophical assumption in order to address the research purpose and these research gaps, this research employs a mixed method strategy with an exploratory design.

The semi-structured interview has been chosen as the initial stage of data collection to explore and identify the role and challenges in Malaysian dry ports, to discover the strategies for their development, and to validate influencing factors of dry port operations and their impacts on seaport competitiveness. This allows the interviewees to introduce new issues and the interviewer to follow up the topics precisely (Stuart et al. 2002). The results from the qualitative phase are used to develop questionnaires for an online survey for further investigation, in-depth understanding and deriving specific information in the quantitative phase (Tashakkori & Teddlie 2003). Combining data interpretation and research findings through exploratory mixed method design will confirm the overall quality of the research.

5.4.2 Research questions

No matter whether the research is qualitative or quantitative, research questions narrow the purpose statement to specific questions to search for the answer (Creswell 2008). In qualitative research, the questions include the central concept or central phenomenon being explored. On the other hand, in quantitative research, the questions relate to the attributes

and characteristics of individuals or organisations which are known as variables (Creswell 2008).

A combination of two different research questions needs to be developed to answer both qualitative and quantitative research questions in this research. Before constructing the research questions, the primary research questions need to be generated (Creswell & Tashakkori 2007). In mixed method research design which emphasises qualitative data, the primary research question should allow for open-ended questions, present overarching questions and facilitate the weighting of qualitative results which will be more dominant than the quantitative results (Alan et al. 2008). Taking this aspect into consideration, the Primary Research Question (PRQ) was derived from the review of literature as follows:

PRQ: How can dry port development in Malaysia enhance the competitiveness of container seaports in the container seaport system?

In general, the PRQ explores how the development of dry ports in seaport systems enhances seaport competitiveness. There are a few criteria that need to be fulfilled to generate qualitative research questions, such as the fact that the question must be open-ended and generalised (Creswell 2013). Also the quantitative research questions have to be very specific in order to understand the variables being investigated (Ayiro 2012). Three secondary research questions need to be generated to research in terms of PRQ. Two of these secondary research questions include SRQ1 and SRQ3 and are related to the qualitative phase, and SRQ2 is based on the quantitative phase.

The first secondary research question (SRQ1), related to qualitative phase, was specially generated to explore the existing role and challenges of Malaysian dry ports in the container seaport system. The identification of these specific roles of dry ports assisted in identifying the particular attributes that contribute to the seaports' competitiveness.

SRQ1: What are the roles and challenges of existing Malaysian dry ports in the container seaport system?

On the other hand, the development of a quantitative research question evolves from the outcome of the qualitative phase. There are also some criteria involved in generating quantitative research questions. The questions should begin with how, what or why (Creswell 2013). The usage of some words, such as describe, compare and relate to, indicates the connection among the variables that are common in quantitative research (Ayiro 2012).

A quantitative research question is an interrogative sentence that asks about the relationship that exists between two or more variables (Ayiro 2012). The SRQ2 is specially designed to determine the factors that influence Malaysian dry port operations and subsequently contribute to the competitiveness of Malaysian major container seaports. The cause-and-effect question in SRQ2 clearly determines the usage of a quantitative method for data collection and data analysis. Underpinned by these criteria, the second secondary research question was developed to provide a platform from which to describe the factors that determine dry port operations as well as its impact for container seaport competitiveness.

SRQ2: What are the influencing factors of Malaysian dry port operations and their impacts on the competitiveness of Malaysian container seaports

The third secondary research question (SRQ3) explores strategies for Malaysian dry port development in the container seaport system. The identification of opportunities for dry ports development, reduces the implications of challenges faced by them and provides a strategic view to generate a development plan for these intermodal terminals in future. The outcomes from qualitative and quantitative phase are combined to answer SRQ3.

SRQ3: What are the strategies for enhancing Malaysian dry port operations and further development?

5.4.3 Research unit of analysis

The unit of analysis refers to a great variety of objects of study, for example, an individual, a program, an organisation, a community, a state or nation (Graneheim & Lundman 2004).

The unit of analysis also refers to someone who can supply the data and determine the level of aggregation that should be investigated to achieve the research purpose and answer the research questions (Zikmund 2010).

The implementation and administration of several organisations as a unit of analysis in a single research study is to rationalise the observation and generalise the results, because this grounds the research by aggregating the perceptions in one section of the organisation with the perceptions of people in another section (Hjern & Porter 1981). The focus of this research is Malaysian dry ports. As the involvement of various players is necessary to ensure the efficiency of dry port operations in the whole supply chain, Malaysian dry port stakeholders, including seaport authorities and operators, dry port operators, government policy makers, transport operators, shippers and freight forwarders, are targeted by this research. They are invited to provide their view on the roles and challenges for Malaysian dry port development in the container seaport system. They are also involved to validate the influencing factors of dry port operations and the impact of dry ports on container seaport competitiveness from perspectives of policy, operational, business, strategic and regional development.

5.4.4 Mixed methods design

Mixed methods research design includes a combination of quantitative and qualitative research data, techniques and methods in a single research study. It enhances the strength

of research by employing multiple methods in a single research study to approach the research problems from various dimensions, focus on a single process and enhance the data accuracy (Janice et al. 2006). This design allows the combination of qualitative and quantitative approaches such as data collection, viewpoints, analysis and inference techniques to develop broader purposes of breadth, depth of understanding and corroboration (Johnson & Onwuegbuzie 2004).

There are four major types of mixed methods design, namely triangulation, embedded, explanatory and exploratory sequential design (Creswell & Clark 2007). Triangulation design is to concurrently collect both qualitative and quantitative data, merge both sets of data and use the outcome to address a research problem (Jick 1979). Embedded design collects qualitative and quantitative data concurrently, but one form of data will support the other form of data (Tashakkori & Teddlie 2003). Explanatory sequential design consists of first collecting quantitative data and then qualitative data to explain and elaborate on quantitative results in detail (Creswell & Clark 2007). Exploratory sequential design begins with qualitative data and then collects quantitative information. The aim of this design is to gather the qualitative data to explore the phenomenon and follow up by using quantitative data to explain the relationships in the previous data (Creswell 2008).

This research has adopted exploratory sequential design to answer the research questions for two reasons. First, there is a lack of academic literature in the context of Malaysian dry port operations in the container seaport system, therefore necessitating an exploration. Second, how Malaysian dry ports operate in the container seaport system to enhance seaport competitiveness requires validation.

This design starts by exploring with qualitative data and analysis and uses the findings in the second quantitative phase as shown in Figure 5.2. The intent of the strategy is to

develop a better measurement with specific samples of populations. This design also permits the data to be generalised from a few individuals in phase one through to the larger sample of population in the quantitative phase (Klassen et al. 2012).

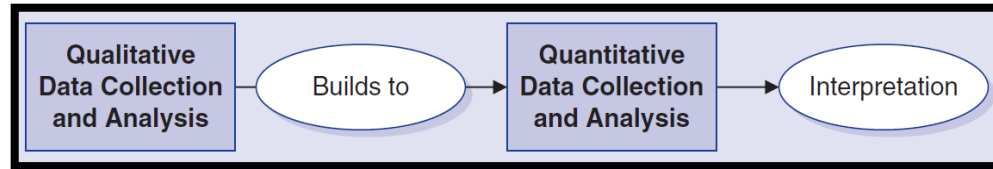


Figure 5.2: The exploratory sequential design
Source: Tashakkori and Teddlie (2010, p. 69)

The combination of qualitative and quantitative approaches allows an exploration of views by listening to participants and following up with sequential questions to gain additional information on certain phenomena (Tashakkori & Teddlie 2010). This research explores the role and challenges of dry ports, discovers strategies for Malaysian dry port development based on dry port stakeholder views, requiring a qualitative data collection strategy. During the qualitative phase, information about the role of Malaysian dry ports was collected. That information is collected from a number of individuals who have experience of and interaction in the process (Morse & Mitcham 2002). Therefore in this research, respondents with vast experience from various organisations were selected to share their involvement in dry port development in Malaysia.

However, the information and knowledge produced from this approach is unable to be generalised to different people, communities or organisations because the findings may be exclusively related to the certain group of respondents in the research (Johnson & Onwuegbuzie 2004). Therefore quantitative research is conducted to generalise the findings by involving many samples from different populations and subpopulations (Johnson & Onwuegbuzie 2004). The objective of the quantitative phase is to validate the data on the dry port operating factors and their impact on Malaysian seaport

competitiveness. The respondents for the quantitative phase were selected from the dry ports' key stakeholders.

The qualitative data are collected for theme development; this is then followed by the quantitative data for the instrument development and qualitative output generalisability in addressing the research questions. Qualitative data are collected to identify the themes, and the developed themes are used to determine an instrument that is parallel to the developed themes. The themes and the statement from the sample are used to create the scales and items in the questionnaire. The final character of mixed methods research is visualisation of the procedure. It is complicated and difficult to comprehend without explicitly representing the mixed method procedure in the research (Ivankova et al. 2006). Therefore, a visual model of the exploratory sequential design procedure has been developed to ensure that the flow of mixed methods is accurately followed (Table 5.1).

The visual model consists of sections that represent phase, procedure and products. The phase section refers to the flow from qualitative data collection, data analysis and instrument development for quantitative data collection. Meanwhile the procedure refers to the sample size, instrument for data collection and data analysis procedure. Finally, products refer to the results of each stage.

In this exploratory sequential design, the mixing or the connections have been made during research question development, selecting the participants, and the quantitative follow-up analysis based on the qualitative results. The additional connecting points are to investigate the results from phase one in more detail through collecting and analysing the quantitative data in the second phase (Creswell & Clark 2011). The connection, mixing and the inferential have been created before the interpretation stage and this shows that an exploratory mixed method design has been implemented throughout the research process.

5.5 Qualitative data collection and analysis

The data collection and analysis procedure for the qualitative phase consist of setting a sampling strategy, questionnaire development and pretesting, administering data collection, data analysis, and proceeding with validity and reliability tests (Creswell & Clark 2011).

Table 5.1: Exploratory sequential design model of the research

Phase	Procedure	Product
Qualitative data collection (Phase One)	<ul style="list-style-type: none"> Individual semi-structured interviews Sampling size (N=14) Respondents: Dry port operator, seaport operator, seaport authority, marine department & ministry of transportation 	<ul style="list-style-type: none"> Audio interview recordings and text data
Qualitative data analysis	<ul style="list-style-type: none"> Manual technique through Grounded Theory Within the case and cross case theme development 	<ul style="list-style-type: none"> Themes identified and classified according to similar and different categories
Development of instrument (Final stage for Phase One)	<ul style="list-style-type: none"> Section A: 6 questions (50%) Role of Malaysian dry ports: (9items) Objective of Malaysian dry ports: (11items) Function of Malaysian dry ports: (7items) Main client of dry ports: (6items) Benefits of dry ports: (13items) Requirements for Malaysian dry ports: (10items) Section B: 4 questions (33%) Strength of dry ports: (8items) Challenges of Malaysian dry ports: (29 items) Strategy to overcome the challenges: (18 items) Opportunities for dry port development: (6items) Section C: 2 questions (17%) Influencing factors of dry port operations: (13 items) Impact of dry ports on seaports competitiveness: (11 items) 	<ul style="list-style-type: none"> An instrument of 3 sections (A-C) containing 141 items to explore the themes and expand Malaysian dry ports' role and challenges in the container seaport system.
Quantitative data collection (Phase Two)	<ul style="list-style-type: none"> Quantitative sampling size (N=260) Online survey via Question pro 4 sections with 77 items Section A, Profile: 5 sections with 30 items (39%) Section B, Influencing factors with 26 items (34%) Section C, Dry port impacts on seaport competitiveness: with 16 items (21%) Section D, Others: 2 Sections with 5 items (6%) 	<ul style="list-style-type: none"> Scores on 5-point Likert scale Multiple choice
Quantitative data analysis	<ul style="list-style-type: none"> SPSS version 22 Exploratory factor analysis (EFA) 4 sections (Section A-D) 	<ul style="list-style-type: none"> Cronbach's alpha and factor loading Pattern matrix model and measurement model Determine dry port influencing factors and the impacts on seaport competitiveness
Inferential of phase one and phase two	<p>Inferential of qualitative and quantitative data for generalisation and further interpretation</p> <p>Summarise the output from both phases and the inferences of both phases.</p>	<ul style="list-style-type: none"> Discussion of the both findings from different phase Implication from the findings

Source: Adapted from Creswell and Clark (2011)

5.5.1 Sampling strategy

The sampling strategy is mainly for the purpose of selecting elements for a population concerned with the research topic in order to develop a reliable conclusion about the population and the research topic (Coper & Schindler 2011). In general, the sampling strategy always depends on the methods chosen and availability of the resources (Kemper et al. 2003). A sampling unit in the population is drawn from a sampling frame or target population that can be accessed in order to collect the required data (Creswell 2012). Therefore, the reliability and validity of the research outcome depends on the appropriate selection in the sampling frame.

In this mixed method research, non-probability sampling for the qualitative phase is used with different sizes of samples depending on the research question and the unit of analysis. However, the main focus will be deriving depth and extensive information across both phases to address the research questions (Teddlie & Tashakkori 2009, p. 181). Convenience sampling, one of the non-probability sampling techniques in qualitative sampling (Teddlie & Yu 2007), was used for this qualitative phase. The intention of convenience sampling is to select the eligible participants who are willing and available to be interviewed within the sampling frame (Klassen et al. 2012). Convenience sampling is carried out by locating potential respondents who meet the required criteria and selecting them on a first-come-first-served basis until the sample size proportion is full (Robinson 2014).

The population targeted was from top-level management, especially from dry ports, seaports, government bodies including the Ministry of Transportation and Malaysian Marine Department, and Malaysian Railway. The position of the participants relevant to the research topic and the accessibility to them were considered when finalising the

sampling list. Moreover, consultation with senior officials from the Ministry of Transportation was carried out to validate the sampling list.

Through the convenience sampling technique, a total of 14 participants from seaports, the rail operator, dry ports and government bodies were selected. Their contacts were available through the Malaysian Ministry of Transportation's public website. All participants, consisting of key senior officers and managers, are knowledgeable about Malaysian dry ports development and familiar with policies related to seaports and inland freight facilities development.

Among the 14 samples, four Malaysian dry port operators were recruited from the four dry ports in Malaysia, i.e. NIP, SIP, ICT and PBCT. Of note is that in these dry ports, participants were limited to only the four respective managers. The reason for this is that the four dry ports had few staff and the other employees were unable to provide valid and reliable information from a strategic, managerial perspective due to their operational position and being not knowledgeable about the research topic.

There were two participants recruited from government bodies, namely the Ministry of Transportation and Malaysian Marine Department. One participant was an official from the National Port Division, Ministry of Transportation, while the other was an authorised person from the Maritime Transportation Division, Marine Department. Participants from the aforementioned government bodies were responsible for policy making and strategic development of the nation's federal seaports and maritime transportation. According to the Malaysian Marine Department (2016), these managers were the key people responsible for improving the quality of the nation's maritime transportation to align with international trade standards.

One participant was recruited from the national sole rail company, Malaysian Railway, to provide significant insights about rail freight systems including seaports and dry ports within and beyond the Malaysian region.

Three participants were recruited from seaport authorities, one each from Port Klang Authority, Penang Port Commission and Johor Port Authority respectively. These are the authorities which administer major Malaysian container seaports. The other three seaport authorities, i.e. Malacca Port Authority, Kuantan Port Authority and Bintulu Port Authority, were not considered for this research as they only handle an insignificant amount of containers.

The four participants from seaport operators were from Westport, PTP, Northport and Penang Port, sampled from a total of 14 seaport operators. These seaport operators were selected based on their role and performance in container operation. Based on MOT (2015), these seaports are leading container seaport operators in Malaysia. The total sample size recruited for this qualitative phase is 14 as shown in table 5.2.

All 14 participants were selected due to their significant profile in maritime transportation, container operations and involvement in the Logistics and Trade Facilitation Master Plan (2015–2020) which is designed to improve inland freight facilities in order to enhance the national trade facilitation mechanism.

Table 5.2: Sampling frame for qualitative phase

Participant	Convenience sampling strategy	Population	Sampling size
Dry port operators	Selecting from dry ports operators in Malaysia	4	4
Ministry of Transportation	Selecting from Port Division	1	1
Marine Department	Selecting from Maritime Transportation Division	1	1
Malaysian railway	Recruiting from the Malaysian Railway operator	1	1
Seaport authorities	Port Klang Authority, Penang Port Commission and Johor Port Authority (major seaport authorities)	6	3
Seaport operators	Westport, Northport, Penang Port and PTP(seaport operator administered by main seaport authorities)	11	4
Total		24	14

Based on their engagement with the government's current agenda, valuable experience, involvement in policy making, strategic planning, dry port operations, container freight transportation and seaport operations, the selected samples possess significant capabilities to provide reliable insights, valid views, opinions and explanations in regard to their responses to the SRQ 1 and SRQ 3.

5.5.2 Questionnaire design and pretesting

Based on the outcomes of the literature review, the questionnaire consists of questions that relate to the role of dry ports, challenges faced by them, and strategies for overcoming those challenges. The questionnaire consisted of three main sections. Section A is to elicit participants' general views about roles dry ports in Malaysia. Six questions were generated to explore the dry port's role, objectives, functions, and the benefits of the dry ports to stakeholders in the container transportation chain.

In Section B, there are four questions generated for participants to identify the strength of Malaysian dry port operations, major challenges, strategies for improvement, and the

opportunity for further development. Section C, which consists of two questions, aims to gain participants' perspectives on their expectations for dry ports and the factors influencing dry port operations to contribute to seaport competitiveness. All information in the questionnaire during the qualitative phase is summarised in Table 5.3.

Table 5.3: Items in the face-to-face questionnaire

Sections	Type of questions	Number of questions	Proportion (%) from total questions
Section A (Role of dry ports in seaport systems)	Open ended question	6	50
Section B (The challenges, opportunities and strategies for dry port development)	Open ended question	4	33
Section C (Influencing operating factors of dry ports vital to seaport competitiveness)	Open ended question	2	17
Total		12	100

A pre-test is a procedure to check survey question comprehensibility and the efficiency of the data collection process (Teddlie & Tashakkori 2009). Before the interview sessions were conducted, all the questions were pre-tested to increase reliability, estimate the length of the interview session, and determine the quality of the questions. This determines whether the respondents in the sample can understand the interview questions (McNamara 1999; Turner 2010).

For this research, pre-tests were conducted by ten academic staff and researchers from the Department of Maritime Logistics and Management at the Australian Maritime Collage, University of Tasmania. The participants in the pre-test stage commented on the covering letter, information sheet, consent form, and questions including the content, sequence and numbers. The output from the pre-test helped the researcher revise the questionnaire. The questionnaire for the qualitative phase is attached as Appendix A in this thesis.

5.5.3 Administration for data collection

The potential respondents were only identified based on their designations and responsibility in the organisations. All participants invited to participate in this research were contacted via email invitation to their respective organisations. The interested participants notified their interest in participating by replying to the invitation emails. A follow-up telephone call was made after sending the invitation email to the respective organisation to discuss venue and date for the interview to be conducted.

A total of 11 interviews were conducted with participants who had given their consent to participate. The interview session took approximately 30–40 minutes at a place and time mutually convenient to the participants and interviewer. The interview session ended when a saturation of information occurred and additional or fresh data would no longer spark new insights or reveal new findings (Charmaz 2006). Before conducting the interview, a minor search was done about the potential participants, their involvement in their current institution, the importance of this research to them and to gain trust from them to be involved in the research (Easterby et al. 2008).

During the interview session a natural setting was applied as one of the major characteristics in the qualitative phase. Natural setting is important for information gathering by actual talking directly face-to-face with respondents and watching them behave and act within their context (Hatch 2001). Therefore, all the interview sessions were conducted in the field and respondent's office. To ensure the originality and development of new themes, in the qualitative research process focus is given to the meaning that the participant expresses about the problem or issue and not to the meaning that is expressed in the literature (Marshall & Rossman 2011). Hence, the interview

sessions were recorded and notes also taken for the purpose of clarity and cross-checking during the transcribing process.

5.5.4 Data analysis

In mixed method research, data analysis may begin at any level of the data collection process. In the qualitative phase, data analysis involves data reduction, data display and data integration (Onwuegbuzie & Teddlie 2003). The recorded interviews were transcribed into an MS Word file and the key points were written down for each interview. Then, the data were analysed through grounded theory which is a set of inductive and iterative techniques designed to identify categories and concepts within text that are then linked to formal theoretical models (Corbin & Strauss 2008). It proceeds through systematic procedures of data collection, categories or themes identification, connecting the themes, and forming a theory that explains the process (Corbin & Strauss 2008).

Grounded theory is a set of methods that consist of systematic and flexible guidelines for collecting and analysing qualitative data to construct theories in the data themselves (Charmaz 2006). It provides better explanations to the theories that are not fully addressed, fits the situation, works in practice and represents all the complexity actually found in the process. It is a systematic qualitative procedure used to develop a theory that explains the interaction about a substantive topic (Charmaz 2006). Grounded theory is a suitable method for case study research (Chamberlain et al. 2004).

On the other hand, thematic analysis involves the search for identification of common threads that extend throughout the entire interview. However, thematic analysis is usually abstract and difficult to identify. Frequently, thematic analysis concepts are indicated by the data rather than concrete entities directly described by the participants (Bowen 2006).

The essence of grounded theory is developing logical themes and sub-themes which together form a 'story', and ongoing development analysis in grounded theory is the main principle that distinguishes between grounded theory and thematic analysis. Moreover, thematic analysis emphasises findings that refer to individual cases but grounded theory findings are meant to generalise across cases (Riessman 2008).

The coding processes in grounded theory focuses on incident by incident, line by line or word by word. In contrast, thematic analysis does not specify a coding technique for associating a particular length of text to code and thematic analysis does not use a constant comparative method as in grounded theory (Floersch et al. 2010).

Grounded theory was applied in this research because it provides a better approach through which to explore dry port operations in the Malaysian container seaport system. The limited amount of research reveals that the concept of dry ports is not fully addressed and it provides only vague information on the emergence of dry ports in the container seaport system in Malaysia. In this regard, this research applied grounded theory to provide clear interpretations on how dry port operators, seaports, policy makers and transport operators feel, think, and behave within a particular context relative to the proposed two secondary research questions.

The grounded theory approach pursues generalisations by making comparisons across the social situation and it has the capacity to encompass many different data and analytic perspectives with real-world problem solving (Corbin & Strauss 2008). This particular strength is crucial to this research in order to ensure data from various stakeholders, including dry port operators, were integrated to provide a systematic approach for the proposed secondary research questions.

As this study required specific attention to explore SRQ 1 and SRQ 3, grounded theory possesses the credibility to collect the necessary information effectively and provide a significant contribution from an academic and managerial perspective. Table 5.4 shows additional justifications on the application of grounded theory in this research and the general comparison between thematic analysis and grounded theory. Data collection and data analysis proceed concurrently in qualitative analysis (Merriam 2002). In the qualitative phase, the text data obtained through the interview process will be analysed for themes with the assistance of the systematic set of procedures to develop and inductively derive grounded theory about a phenomenon (Strauss & Corbin 1998).

Table 5.4: Grounded theory vs thematic analysis

Characters	Grounded Theory	Thematic Analysis
Read verbatim transcripts	✓	✓
Identify possible themes	✓	✓
Compare and contrast themes	✓	✓
Build theoretical models	✓	X
Constantly checking them against the data	✓	X
Interpretation supported by data	✓	✓
Data sets	Smaller data sets	Larger data sets
Reliability	Very high	Greater concern
Dimension view	Views the relationship and connections between data	Views the pattern in the dataset
Techniques	Properly done, requires an exhaustive comparison of all text segments. Theoretical models built on themes/ codes that are 'grounded' in the data	Uses techniques in addition to theme identification, including word searches and data reduction techniques
Primary goal	Describes and understands how people feel, think, and behave within a particular context relative to a specific research question	Understands the meanings that people give to their lived experiences and social reality

Sources: Adapted from Ryan and Bernard (2003); Charmaz (2006); Corbin and Strauss (2008)

A systematic design procedure in grounded theory emphasises the use of data analysis steps of familiarisation, reflection, open coding, axial coding and selective coding (Creswell & Clark 2011).

Familiarisation and reflection assist in understanding the content of the interview transcripts, becoming conversant with the detail from each respondent and crosschecking the initial finding with the previous literature or with other cases (Strauss & Corbin 1998). Open coding is the initial categorisation of information about the phenomenon being studied by segmentation of the information.

The axial coding phase involves development of the interrelationship of causal conditions, strategies and consequences (Strauss & Corbin 1998). In selective coding, the interrelationship of the categories will be identified to provide abstract explanations for the process being studied in the research. All those five techniques are used to narrate a story which interconnects the categories and identifies specific factors influencing the phenomenon. Table 5.5 shows a model of the coding process in the qualitative phase.

Table 5.5: Visual model of coding process in qualitative phase

Stage	Process	Output
1.Familiarisation	Initially read through the text data	Many pages of text
2.Reflection	Cross-check and divide the text into segments	Many segments of text
3.Open coding	Label the segments with codes	30–40 codes
4.Axial coding	Reduce overlap and redundancy of codes	Codes reduced to 20
5.Selective coding	Collapse codes into themes	Codes reduced to 5–7 themes

Source: Adapted from Creswell (2008)

5.4.5 Validity and reliability

Validity in the qualitative phase is achieved by employing certain procedures to determine the accuracy level and reliability, and indicates that the approaches used are consistent across different types of research (Gibbs et al. 2007). Validity is one of the strengths of a qualitative method and it determines the findings are accurate from various perspectives (Creswell & Amanda 2008). Multiple approaches have been implemented in the qualitative phase in order to enhance the ability to assess the accuracy of findings (Klassen

et al. 2012). The validity in the qualitative phase was determined by the following procedures:

- Triangulation has been implemented during the interview session. The triangulation technique is cross-case analysis to test the findings during the interview session (Reason & Rowan 1981). If the answer from different organisations for the same question has highly matched characteristics the finding is highly trustworthy (Reason & Rowan 1981). Hence, after each interview session, the outcome was crosschecked with the previous session to ensure the trustworthiness of the data.
- Reflexivity was used as a sequential test to verify the validity of the qualitative data. Reflexivity refers to the ability to examine oneself (Padgett 2009). During the data gathering, open disclosure of preconceptions and assumptions may affect the output (Padgett 2009). Therefore neither emotional struggle nor conflict of interest influenced the researcher during the interview session, thereby reducing the risk of bias in the results.
- The member checks technique has been applied. At this point, all the collected data were sent to the research participants to obtain their feedback. In qualitative research, this feedback from the participant validates the interpretation of the interview (Tutty 1996).
- Spending a prolonged time in the field is one of the methods used to determine whether the collected data are valid. In this way, in-depth understanding of the phenomenon can be developed. The more experience gained with the participant and the phenomenon, the more accurate or valid will be the findings (Creswell 2013). Although the time allocated for interview was only 30–40 minutes, during the interview the participants

were motivated by some additional questions, which prolonged the interview duration to more than an hour.

The reliability of the qualitative phase was ensured by the following procedures:

- During each interview session, thorough notes were taken and the interview was recorded with the participant's permission. This enhanced the reliability and good organisation of the data so that they were easily retrievable by other researchers for re-analysis (Marshall & Rossman 1995).
- Crosschecking coding was built into this phase to improve the reliability since humans are exposed to numerous judgement errors (Franklin & Jordan 1997). During the qualitative data analysis, crosschecking through various coding processes was implemented. Open coding, axial coding and selective coding were executed to refine the interpretation of answers from the respondent, which increases the reliability of the output at this phase. During coding sessions, multiple crosschecks against the existing literature were carried out in order to determine a solid concept through the new findings. This contributed to the new findings on dry port concepts from the Malaysian standpoints.
- Transcripts were checked regularly to ensure that the transcripts did not contain obvious mistakes made during transcription (Creswell 2013). The transcription was carried out after each interview session to draw on fresh memories of the interview with the respondent in order to reduce the percentage of mistakes while transcribing the text. In addition, the transcript was re-checked a few times to enhance the credibility of the data.

5.6 Quantitative data collection and analysis

In the quantitative phase of this research, data were collected through an online survey. An online survey has the ability to provide access to groups or individuals who would be difficult or impossible to reach through other channels (Couper 2004). Another reason for using an online survey is that it can reach thousands of people who may be separated by great geographical distance in a short amount of time and the unique samples in a certain population (Taylor 2000; Couper 2004).

The second phase of the research focuses on validating, explaining and generalising the result obtained in the qualitative phase. This phase concentrates on the influencing factors of dry port operations and their impact on seaport competitiveness. The procedures for data collection in the quantitative phase consisted of sampling strategy, online questionnaire design and pre-testing, administering data collection, data analysis and proceeding with the validity and reliability test.

5.6.1 Sampling strategy

For the online survey, a list-based stratified sampling technique was applied to stratify dry port stakeholders to obtain homogeneous subgroups (Collins et al. 2007; Fricker 2008). One of the characteristics of an exploratory sequential design is that the samples in both phases must be different in order to determine the credibility of the exploratory sequential design and the validity of the data (Creswell & Clark 2011). Therefore, a list-based stratified sampling technique is used because it increases the sample's statistical efficiency more than simple random sampling and is suitable for the survey when the respondents' organisations are scattered (Cooper & Schindler 2014).

This sampling strategy is used to garner adequate data for analysing the multiple subpopulations. It is effective for studying a certain population's characters, their points of view or their standing on certain issues (Creswell 2008). The stratification from different groups enhances the statistical efficiency because this sampling exposes the homogeneity among the populations and reveals heterogeneity between the populations (Cooper & Schindler 2014). Application of this sampling design gains more control of the sample and restricts false identity which is common in internet-based surveys (Simsek & Veiga 2001). This sampling technique is very accurate compared to simple random sampling, keeping a record of the availability of respondents and generating more representatives in each stratum (Bethlehem & Biffignandi 2012).

The target respondents for this quantitative phase of research were the key stakeholders of dry ports in Malaysia. The population is segregated into six (6) strata which consist of hauliers, freight forwarders, shippers, shipping lines, seaport operators and the rail operator. However, these six strata are homogenous and non-overlapping to ensure maximum representative samples (Bethlehem & Biffignandi 2012). Top-and middle-level managers from the abovementioned subpopulations who are directly involved in managing intermodal terminals, freight distribution and related logistic operations were invited to participate due to their experience and knowledge in dry port operations.

The respective stakeholders in each stratum are the key players in the container seaport system and the main users of Malaysian dry ports. They are expected to contribute their perspectives or points of view on the major operating factors influencing dry port operations, and to specify the impact of dry port operations on seaport competitiveness in order to answer SRQ2. The sampling frames in terms of the six strata are described as follows:

1. Freight forwarder stratum

Samples of forwarders were derived from the list in the Federation of Malaysian Freight Forwarders, along with their email address. In that list, there were 119 freight forwarders and all of them were targeted to participate in the survey. These 119 freight forwarders have a good reputation for recorded reliable services, efficiency, charges and management of damaged cargo. Freight forwarders are sensitive on price issues, seaport and inland freight facilities efficiency (Tongzon 2009). Therefore, the opinion from forwarders on the influencing factors on dry port operations and the impact on seaport competitiveness will be of value to this research. A total of 119 emails were sent to Malaysian freight forwarding companies to those in the positions of Chief Executive Officer, General Manager and Operational Manager, Branch Manager and Operational Executive.

2. Haulier stratum

There are 60 active haulier members in the list provided by the Association of Malaysian Hauliers, and all of them were recruited for survey. In Malaysia, hauliers obviously utilise the inland facilities the most in order to provide freight transportation services to and from seaports for their clients. Emails were sent to 60 officials with positions of Chief Executive Officer, General Manager and Operational Manager as they are involved in decision making and were knowledgeable about the strategic development of hauliers in relation to dry ports.

3. Shipping line stratum

The inland components of seaports are one of the important criteria for shipping lines when choosing seaports. Hence, shipping lines were selected to be involved in this survey and provide their perspectives on dry port operations. A list of shipping lines was prepared

based on the information obtained from three major Malaysian container seaports, i.e. Penang Port, Port Klang and PTP. There were 116 companies calling at Malaysian major seaports, of which 30 were container liners with 100 TEU or more capacities. As this research focuses on container transport, a total of 30 container shipping lines were selected to be surveyed. Container shipping lines calling at multiple ports, e.g. Maersk Line and Evergreen were only selected once to avoid duplication of responses.

According to Bergqvist and Langen (2015), shipping lines are highly focused on minimising operational cost and turnaround time. The ability of shipping lines to provide door-to-door delivery besides port-to-port makes them highly concerned about the efficiency of inland freight facilities, asset utilisation and rapid responsiveness in order to cater for cost-driven customers. Therefore, their role in container transportation makes them highly suitable for involvement in the quantitative phase.

A total of 30 emails were sent to shipping line officials with positions of Chief Executive Officer, General Manager and Operational Manager, Branch Manager and Operational Executive.

4. Shipper stratum

A total of 20 shippers were recruited based on a customer list provided by Penang Port, Port Klang and PTP. The select criteria of shippers to participate in this research included their frequency of transaction, volume of containers and location of shippers in the different regions besides Klang, Penang and Johor. They are located in the regions connecting to the ports of Klang, Penang and Johor, and are involved directly in container transactions with those seaports. The proportion of shippers is less than freight forwarders because most shippers use freight forwarders, 3PL or 4PL, to manage their goods.

According to Roso (et al. 2009), shippers utilise the rotation of empty containers by optimising inland terminals and infrastructure and hold accurate information on the origin and destination of the containers, therefore they are required to be involved in this research. Twenty emails were sent to the respective shippers targeting their General Manager and Operational Manager, Branch Manager and Operational Executive in order to gain reliable and valid respondents.

5. *Rail operator stratum*

Malaysian Railway is a single operator and it has operational branches in each region. The rail network is not fully operational throughout peninsular Malaysia because there are no rail gauges available in certain regions of the peninsular, especially in the eastern region. Therefore, respondents from the northern, central and southern regions were invited to participate in the survey. However, not all branches accept containers as some of the branches mainly focus on managing bulk cargo and passenger terminals. There are five regional branches that handle containers in peninsular Malaysia, namely Padang Besar, Butterworth, Klang, Kuala Lumpur and Johor.

In each branch, there is an Operational Department and a Logistics Department led by a manager in each department. Both of these managers in each branch were selected because of their knowledge of container handling and intermodal transportation as well as possessing experience in rail terminal–customer–rail terminal container transportation. Although there are other departments in these branches, the managers from these departments were not included because their knowledge and experience is not relevant to the aim of the research. Therefore, 10 participants from the northern, central and southern regions were selected to represent the Malaysian rail operator.

6. *Seaport operator stratum*

There are three major container seaports, namely Port Klang, Penang Port and PTP, operating in this region therefore all of these seaports were included for the survey. Each seaport has regional branches located in the northern, central and southern regions, with two branches operated by Penang Port and one branch each operated by Port Klang and PTP respectively. Hence, operational, container and logistic executives from the branches were also invited to participate in the survey. As a result, 21 participants from seaport operators were recruited for the survey. The total sample size recruited for this quantitative phase is 260, as shown in Table 5.6.

Table 5.6: Stratified sampling strategy for quantitative phase

Stratum	Sampling frame	Population	Sampling size
Freight Forwarders	Selecting from the member list of Federal of Malaysian Freight Forwards.	119	119
Haulers	Selecting from the member list of Association of Malaysian Hauliers.	60	60
Shipping Lines	Container liners with capacity more than 100 TEUs and choose Port Klang, PTP and Penang Port as port of call.	116	30
Shippers	Key shippers listed in Port Klang, PTP and Penang Port.	20	20
Rail Operators	Samples selected from 5 regional branches of Malaysian Railway that handled containers.	10	10
Seaports	Selecting operational, container and logistic executives in all seaports including its branches.	21	21
Total		346	260

It should be noted that there were no representatives from dry ports during the quantitative phase because all four managers had already been selected for the interview phase. Limited employees at management level became a main restriction when inviting participants from dry ports to be involved in the quantitative phase. During the interview sessions with dry port managers, the researcher had asked them to provide potential respondents for the online survey but they stated that other personnel are mainly responsible for lower-level daily operational work and would be unable to provide

opinions from managerial and strategic perspectives. Therefore, including these lower-level personnel in the survey may affect the reliability and validity of the data (DuBrin 2003).

Moreover, the dry port managers who had been interviewed had already contributed valuable information for the researcher to develop and construct the online questionnaire. If the four managers were interviewed again for the online survey, it would deviate from the guidelines for exploratory sequential design mixed methods research, i.e. the same samples should not be used in both phases (Klassen et al. 2012).

5.6.2 Questionnaire design and pretesting

At this quantitative phase, the information pertaining to the influential factors of dry port operations in Malaysia and the impact of dry ports on seaport competitiveness had to be collected from dry port stakeholders. In designing the questionnaire, the outcomes from the literature review and interviews were used. Literature such as Rodrigue et al. (2006); Jarzemkis and Vasiliakas (2007); UNESCAP (2008); Roso et.al (2009); Panayides and Song (2009); Bergqvist et al. (2010); Roso and Lumsden (2010); Woxenius and Bergqvist (2010); Hanaoka and Regmi (2011); Padilha and Ng (2012); Gujar and Thai (2013); Ng et al. (2013) and Nguyen (2014) that indicate the relevant factors influencing dry port operations were considered. The online questionnaires contain five-point scale Likert-type questions.

The main reason for choosing a Likert scale is because it clearly reflects the level of agreement on the importance of certain constructs and dimensions (Teddlie & Tashakkori 2009) which is important for dry port operations in a container seaport system. Secondly, it provides optimal length of rating to maximise reliability and validity of the results (Dawes 2008). Thirdly, a Likert scale fits very well with online surveys and, finally, this scale is

appropriate for a cluster of items defining certain standardised functions and indicators (Cooper & Schindler 2011). In total, there are 77 questions that were generated for the questionnaire, grouped into four different sections as listed below:

- Section A: Respondent's background
- Section B: Influencing factors of dry port operations
- Section C: Impact of dry ports on seaport competitiveness
- Section D: Others

All the questions were generated precisely to answer the research question and only consume approximately 15–20 minutes of the respondent's time. This strategy reduces the length of the survey, reduces the amount of time needed for respondents to answer the questions and increases the response rate (Martine & Jankowski 2006). Table 5.7 shows the items developed in the online questionnaire in the quantitative phase.

Table 5.7: Items in the online questionnaire

Sections	Type of questions & total questions	Number of questions	Scale type	Proportion (%) from total questions
Section A	Multiple choice-select one answer (5)	30	Multiple choice	39
Section B	Matrix choice-one answer per row (5)	26	5-point Likert scale	34
Section C	Matrix choice-one answer per row (5)	16	5-point Likert scale	21
Section D	Multiple choice-select one answer (1) & Matrix choice-one answer per row (1)	5 (3 multiple choice & 2 matrix choice)	5-point Likert scale (for matrix choice)	6
Total		77	-	100

In the quantitative phase, pre-testing is vital for verifying some ethical issues, testing the appropriateness of the instrument and assessing the feasibility of the questionnaire (Teddlie & Tashakkori 2009). The pre-test assists in determining whether the individuals in the sample are capable of completing the survey and understand the questions. Through

the pre-test, the stability and consistency of the questions have been established (Creswell 2008).

Paper-based pre-tests had been conducted for the quantitative questionnaire. A group of people including academic staff and researchers from the Department of Maritime Logistics and Management at the Australian Maritime College, University of Tasmania were selected to validate the content of the instrument and these professionals were excluded from the major research. In this pre-test, participants provided their opinion on inconsistencies in wording, format, order of questions, item scaling, information and timing. The format and questions were revised according to participants' views.

After receiving ethics approval for the quantitative phase, the online survey was prepared with QuestionPro.com. The same group of people from the University of Tasmania were invited to pre-test the online survey and requested to provide their comments with regard to clarity, sequence and appearance. The online survey was finalised after several consultations with the researcher's primary supervisor and finally the online version of this instrument was executed after obtaining approval from the ethics committee. The online version of the survey and the ethics approval are attached in Appendix C and D respectively.

5.6.3 Administration for data collection

After designing and pre-testing the questionnaire, the survey was officially administered from 15 December 2014 to 15 January 2015. The following measures were taken to administer the survey as suggested by Gosling et al. (2004) and Sue and Ritter (2012):

- 1) The web-based questionnaire was designed using QuestionPro.com website. The web link was set up and linked with the researcher's own email in order to collect the

responses from the participants. At this stage, six email collection points for the six different strata was developed in order to send a reminder to the respondents and also to track the respondents through the QuestionPro.com server. Moreover, all six collection points were designed to block multiple responses, allow flexibility in answering, editing or finishing an incomplete survey and returning the survey at any time. In addition, the respondents' IP identification and email address were saved for tracking purposes.

- 2) One week before the survey was available, on 8 December 2014, the respective respondents received a notification about the significance of their involvement in this research. This early announcement encourages a high response rate, which is crucial in an online survey (Dilman 2002).
- 3) After one week, the original questionnaire was emailed to the respondent. Personalised emails were sent to 260 respondents within the six different strata. Participants were asked to complete the questionnaire by clicking on the web link indicated in the email. Receiving participants' completed questionnaires implies their consent for participating in this survey. Out of a total of 260 emails, 11 emails bounced, four emails stated that the respondent would proceed later because they were occupied with fieldwork, while one respondent requested further information about the research.
- 4) After two weeks, on 29 December 2014, a second questionnaire was sent to the respondents who had not replied or answered the questionnaire. Finally, after three weeks, a third email was sent, emphasising the importance of the respondent's participation in the research (Dilman et al. 2009).

5) In the fourth week, on 8 January 2015, a final reminder was sent to the non-respondents. At the beginning of the fifth week, the online survey data collection was closed.

5.6.4 Data analysis

In the quantitative phase, a mixture of descriptive and inferential statistical analysis was used by exploratory factor analysis (EFA). EFA is exploratory in nature and it investigates the main dimensions to generate a concept, theory or model from a large set of items (Williams et al. 2010).

In this research, EFA was applied to validate and explore the relationship among the factors that influence Malaysian dry port operations and the impact of dry ports on seaport competitiveness. The objective of the second phase of the research was to evaluate these factors and construct a parsimonious description of the data structure. Both of these approaches are important to define newly developing features or dimensions of the factors that underline the set of items (Tabachnick & Fidell 2000).

The nature of this research is mixed methods, focusing on exploratory sequential design and an application of EFA to validate the themes that emerges from a constant comparison phase (Creswell & Clark 2007). According to Hurley (1997), the EFA technique is suitable for factor exploration and evaluation compared to confirmatory factor analysis (CFA). The statistical analyses of the quantitative results were conducted with the assistance of Statistical Package for Social Science software (SPSS) version 22.0. The output from the analysis was displayed through table, charts and graphs.

However, interpretations on dry port development in relation to the enhancement of container seaports competitiveness have been derived from data integration from both

phases (Greene et al. 1997). Data integration strategy consists of presenting data from both phases coherently as shown in Figure 5.3 (Onwuegbuzie & Teddlie 2003). In mixed methods research, data integration is crucial for comparison, consolidation, infusing, building and embedding the outcome from the qualitative phase with the quantitative phase and vice versa to develop a new clarification and understanding (Teddlie & Tashakkori 2006). This process is critical in order to determine the quality of the outcome in mixed methods research which has been a significant advantage of these methods (Teddlie & Tashakkori 2003).

5.6.5 Validity and reliability

In quantitative analysis, validity is measured to evaluate whether the scores obtained from the instruments are sensible, meaningful and enable the development of a good conclusion from the sample that is being studied to the population (Rudner 2001).

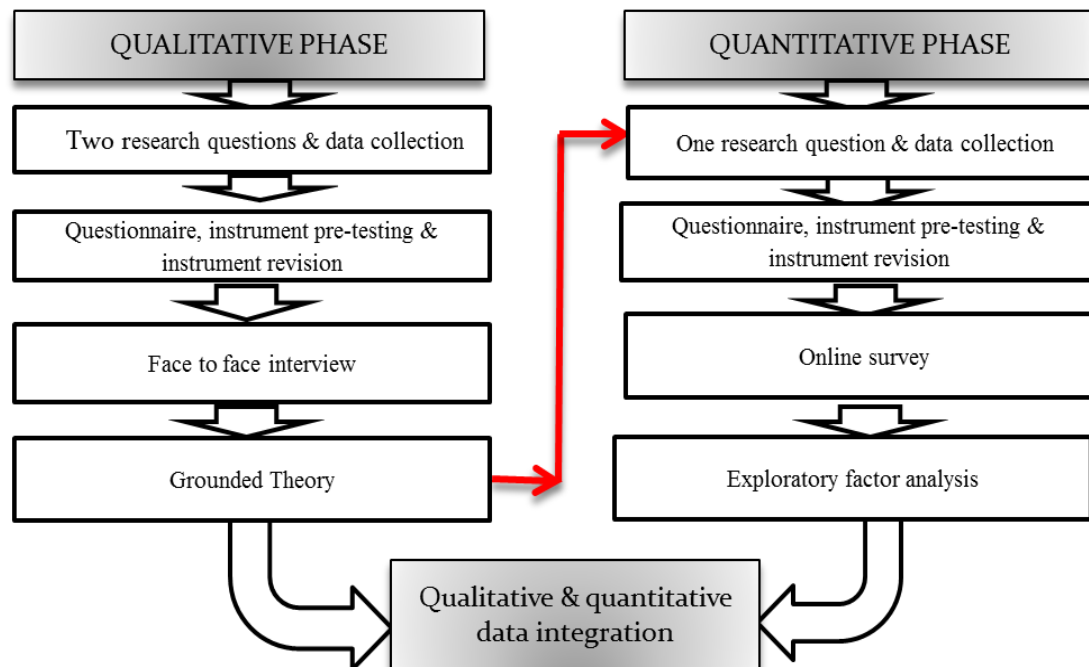


Figure 5.3: Data integration in mixed method research
Source: Adapted from Teddlie and Tashakkori (2003)

Meanwhile, reliability refers to the accuracy of a measurement procedure (Rudner 2001).

In order to determine the validity of the outcome, the following procedure was carried out:

- In EFA, several assumptions suggested by Pallant (2011) such as sampling adequacy, correlation coefficient, and communalities analysis were analysed to ensure the validity and generalisability of the output. The outcome from all assumptions shows that the results are valid and appropriate for generalisation.
- The content validity validates the questions representing all of the possibilities of questions available. Content validity was assisted by participants and academic professionals in pre-testing and commenting especially on the content of the survey questions, structure of survey and the scale (Shepherd & Helms 1995; Rudner 2001).
- The stability of the instrument is obtained through the pre-test of the survey instrument. The stability of the instrument shows almost identical results with repeated administering of the same instrument to the same samples with sufficient time intervals (Klassen et al. 2012).
- The development of stratification and optimising the entire sampling frame for the data collection enhance the internal consistency of the quantitative phase data collection.
- The survey questions were based on the literature and qualitative outcome. Moreover, the literature covering studies on dry ports in other continents such as Europe, Africa, America and some countries in Asia was included. Hence, these procedures reflect the application of construct validity, external validity and generalisability of the quantitative phase.

The coefficient-alpha is generated to test the reliability of internal consistency. The items scored are continuous variables i.e. “Strongly Agree” to “Strongly Disagree”, the alpha

provides the coefficient to estimate the consistency of scores on an instrument. In the coefficient-alpha test, the higher the score the more reliability there is in the generated scale in the questionnaire (Klassen et al. 2012). The acceptance coefficient value has been indicated as 0.7 and above as acceptable (Garver et al. 2008).

5.7 Research ethics

Ethical issues become vital and significant to producing a good administration procedure in research (Israel & Hay 2006). Some ethical issues include informed consent, confidentiality and anonymity, use and misuse of data, ownership of data and conclusion, honesty and trust, reciprocity, intervention and advocacy, harm and risk, and conflict of interest (Puch 2006; Resnik 2011). Many authors such as Tashakkori and Teddlie (2010), Creswell and Clark (2011) and Crowe et al. (2012) recommend that the ethical issues should be addressed throughout the research procedure. In this research, the research area and topic were selected after a deep discussion with academics and supervisors in the Department of Maritime Logistics and Management (MLM) of the Australian Maritime College (AMC).

A thorough literature review was carried out to explore the role, challenges and strategies for dry port development, global experiences in dry port development, influencing factors of dry port operations and the impact of dry ports on container seaport competitiveness. The research topic proposal was presented to a panel during the candidature confirmation process to obtain approval and to recognise the research area for further exploration.

Ethics approval for this research was obtained from the authority of the Human Research Ethics Committee (Tasmania), which is directly linked to the Tasmania Social Science Human Research Ethics Committee (UTAS 2011). An ethics proposal needs to be prepared and presented to the ethics committee that is governed by the Social Science

Human Research Ethics Committee and the Australian Code for the Responsible Conduct of Research (Australian Government 2014). Table 5.8 shows the strategy applied to prepare the ethics application.

Table 5.8: Flow of ethics application for the research

Steps	Explanations
1.	Identify risks for ethics application.
2.	Phase 1: Complete low-risk application form, information sheet, consent form, semi-structured interview questions (pre-tested), potential participants and interview schedule.
2.	Phase 2: Included in the application with information sheet, list of potential participants and online survey questions (web link).
3.	Consultation with supervisors and approved by Head of the Department, then submit the ethics application to the Ethics Committee.
4.	Ethics approval granted.
5.	Ethics application was re-submitted to the Ethics Committee for the clearance for online survey. Initially the web link and the survey questions are not submitted because quantitative phase continues from qualitative phase. Data from phase one are needed to construct the online survey. Therefore, the application was re-submitted with the necessary information.

Ethics approval is needed for the process of data collection from various organisations (Israel & Hay 2006). There will be two stages of ethics application for face-to-face interviews and online surveys. This research was classified as having a minimal ethical risk. The ethics application detailed that the identity of respondents would remain confidential, and the primary objective of the interview was to discover the role of Malaysian dry ports and explore the challenges and strategy for Malaysian dry port development. The interview phase generates initial findings on the influencing factors of dry port operations and their impacts on seaport competitiveness which was to be validated during the quantitative phase.

During the qualitative phase, a recruitment invitation was sent prior to participants' confirming their participation with a consent form. In the quantitative phase, participants

were asked to complete the questionnaire by clicking on the web link indicated in the email. The ethics process was completed with approval to conduct both phases of the research being given by the Human Research Ethics Committee, University of Tasmania.

5.8 Procedures for bias management

Bias management throughout the research ensures the quality of the research. Normally bias occurs during presentation and report writing (Creswell 2012). During the qualitative phase data collection, the most important technique to minimise bias is to establish rapport and trust with the respondent (Zikmund et al. 2010). Therefore, in this research, the respondent has been contacted via telephone and email so that the researcher understands their social context before conducting the interview. Other than establishing rapport with the interviewee, several subsequent strategies have been implemented in both phases:

- The first of these is being ethical, especially during data analysis and presenting the findings (Rudestam & Newton 2001), and by preventing the influence of personal experience, beliefs and judgement during the interviews. Moreover, the interview session was recorded for reference and final data integration (Creswell 2012).
- Sensitive and offensive language is avoided. Gender-biased words, suggesting judgements or reinforcing stereotypes are examples of those categories of expression (Rudestam & Newton 2001).
- Using appropriate research terminologies and, finally, the fourth strategy is that of pre-testing the interview and survey questions (Creswell 2012).
- Pre-testing the interview and online survey questionnaires in order to prevent any bias during data collection procedure.

- Validating all assumptions in EFA, including sampling adequacy, correlation coefficient and communalities analysis in order to avoid bias in the statistical results (Pallant 2011).

5.8.1 Procedures for error control

Error control is an important element in maintaining the quality and authenticity of the overall research. Therefore, Salant and Dillman (1994) have suggested four critical guidelines to maintain the quality of the research:

- 1) Having a wide-ranging sampling frame to decrease coverage error. Coverage error arises from the sample when it fails to include all elements from the target population (Salant & Dillman 1994). To ensure the sample has all elements from the target population in this research, only the most updated and most recent information was used to prepare a sampling frame in both phases, and unqualified and duplicate entries were eliminated from the sampling frame (Salant & Dillman 1994).
- 2) Selecting a large sample to reduce and prevent sampling error is one of the techniques used to control error in the research. Sampling error occurs when a specific sample is drawn from the target population instead of taking the whole target population into consideration (Dillman et al. 2009). During the qualitative phase, the samples were selected via convenience sampling because this strategy provides the option of selecting participants who are willing and available (Klassen et al. 2012). During the quantitative phase, the samples were segregated into six main strata consisting of different stakeholders. The entire list from the sampling frame with selected criteria was adopted for data collection to reduce sampling error.

- 3) Implementing a well-planned instrument, especially for questionnaires, reduces the errors in the measurement. Measurement error results from inaccuracy and imprecise responses from the respondents (Salant & Dillman 1994). Besides implementing exploratory mixed methods research which clearly distinguishes the purpose and procedures of both phases, a simple web-based questionnaire, user-friendly characteristics, correct question order, and appropriate scale managed to reduce measurement errors (Cooper & Schindler 2011).
- 4) Implementing rigorous and convincing administration procedures to reduce non-response error is the final part in error control. The implementation of convenience sampling during the qualitative phase and stratified purposeful sampling during the quantitative phase were to ensure appropriate information-rich participants with sufficient response rates. Moreover, introductory emails and follow-up telephone calls were made before conducting face-to-face interviews. Pre-invitation, invitation and follow-up emails were sent to the respondents before closing the web-based survey. These procedures assisted the increase in response rates in both phases.

5.9 Summary

This chapter discussed the research philosophy, research approach, research design and ethics. A pragmatic research approach has been proposed to address the research problem. Moreover, the nature of pragmatic design which focuses on pluralistic and consequence suits exploratory data collections, analysis and interpretation. This justification underpins the decision to use mixed methods in this research. A mixed methods methodology adopting exploratory sequential research design was adopted for qualitative and quantitative data collection. Face-to-face interviews followed by online surveys were used as the method of data collection.

The data collected from the two different research phases are analysed and discussed in Chapters six, seven and eight. The following chapter discusses outcomes from the qualitative phase which explored the roles and challenges of Malaysian dry ports in the container seaport system.

CHAPTER SIX

QUALITATIVE DATA

ANALYSIS AND

DISCUSSION

6.1 Introduction

The previous chapter discussed the mixed method research methodology used in this study. This chapter reports and discusses the empirical findings of the qualitative phase of the research. Face-to-face interviews were employed in the qualitative phase to answer the first secondary research question as stated below.

SRQ1: *What are the roles and challenges of Malaysian dry ports in the container seaport system?*

Firstly, this chapter explains the profile of 11 participants involved in semi- structured interviews, and presents the procedure of data analysis by applying grounded theory. Subsequently, it discusses the findings relating to the role and challenges of dry ports in Malaysian container seaport systems. The findings include Malaysian dry port objectives, functionalities, users, benefits, operational requirements, strengths and challenges of the dry ports. Finally, it presents interviewees' views on the influencing factors of dry port operations, and how dry ports impact the competitiveness of seaports. The outcome will be validated in the quantitative phase through an online survey to key Malaysian dry port users.

6.2 Profile of respondents

A total of 14 targeted participants from four different groups of organisations were invited for interviews, namely, Malaysian dry port operators, seaport operators, Malaysian government bodies and Malaysian railway. Eleven (11) participated and a response rate of 79% was achieved. Among the participants, four were dry port operators from the four Malaysian dry ports, one was a manager from the Malaysian seaport authority and three were seaport operators from North Port, PTP and West Port. Two participants were from

government bodies involved directly in the development of dry port policies in relation to management and structure. One respondent was from Malaysian Railway. The total interview time spent (in minutes) with all 11 participants was 875 minutes, ranging between 45-130 minutes, and the average was 79.5 minutes per interview.

About 73% of the respondents possessed more than 10 years of experience and 27% had 6 to 10 years of experience in their respective fields. From the perspective of academic qualifications, 64% of the participants held a Bachelor degree from a local university and 36% attained a master's degree from a local or international university. This implies that all participants had sufficient knowledge, wide experience in the current state of Malaysian maritime logistic and the capacity to provide strategic point of views on the topic of this research. Interviewing professional participants made the coding process easier as they provided well formulated responses coherently (Aberbach & Rockman 2002). Table 6.1 shows the profile of interviewees and the duration of the interview sessions with each one.

6.3 Procedure of data analysis

Familiarisation, reflection, open coding, axial coding and selective coding are the main procedures for data analysis in grounded theory (Beattie et al. 2001; Locke et al. 2002; Easterby et al. 2008).

Table 6.1 Profile of interview participants and interview durations

No.	Identity code	Participants	Years of experience	Designation of respondents	Academic qualification	Organisations	Interview session	Duration of interview
1.	*FIP 1	Seaport authority	16 years	Executive-container division	Bachelor degree	Penang port	7 th Dec. 2013 09:15-10:30	75 minutes
2.	FIP 2	Dry port operator	9 years	Corporate manager	Bachelor degree	Padang Besar Cargo Terminal	9 th Dec. 2013 11:20-12:15	55 minutes
3.	FIP 3	Railway operator	12 years	Operation manager	Bachelor degree	Malaysian Railway	9 th Dec. 2013 15:10-16:20	70 minutes
4.	FIP 4	Dry port operator	8 years	Assistant manager	Bachelor degree	Ipoh Cargo Terminal	15 th Dec. 2013 14:15-15:05	50 minutes
5.	FIP 5	Government body	15 years	Assistant manager- shipping and port division	Bachelor degree	Marine Department	17 th Dec. 2013 08:30-10:05	95 minutes
6.	FIP 6	Dry port operator	10 years	Branch manager	MBA	Nilai Inland Port	19 th Dec. 2013 09:00-09:45	105 minutes
7.	FIP 7	Seaport operator	21 years	Advisor-division of planning and development	MBA	North Port	21 st Dec. 2013 10:20-12:30	130 minutes
8.	FIP 8	Dry port operator	7 years	Manager	Bachelor degree	Segamat Inland Port	27 th Dec. 2013 16:15-17:00	45 minutes
9.	FIP 9	Government body	15 years	Assistant manager- shipping and port division	MBA	Ministry of Transportation	28 th Dec. 2013 09:30-11:35	125 minutes
10.	FIP 10	Seaport operator	8 years	Marketing manager	MSc.	WestPort	3 rd Jan. 2014 15:20-16:30	70 minutes
11.	FIP 11	Seaport operator	11 years	Operation executive-container division	Bachelor degree	PTP	4 th Jan. 2014 12:05-13:00	55 minutes

* Face-to-face interview participant (FIP)

Figure 6.1 indicates the process of data analysis for this research based on grounded theory. It combines formal and informal data processing. Familiarisation and reflection were carried out as informal procedures; open, axial and selective coding processes are formal procedures used to derive the precise interpretation of the responses from each interviewee.

Familiarisation is the first stage in qualitative data analysis, which starts from day one of the interview session. At this stage, the input from each interview session was transcribed immediately and the transcript was re-read to enable familiarisation with the responses received from each respondent. The intention of the familiarisation process is to identify the concept or categories related to the research (Strauss & Corbin 1998).

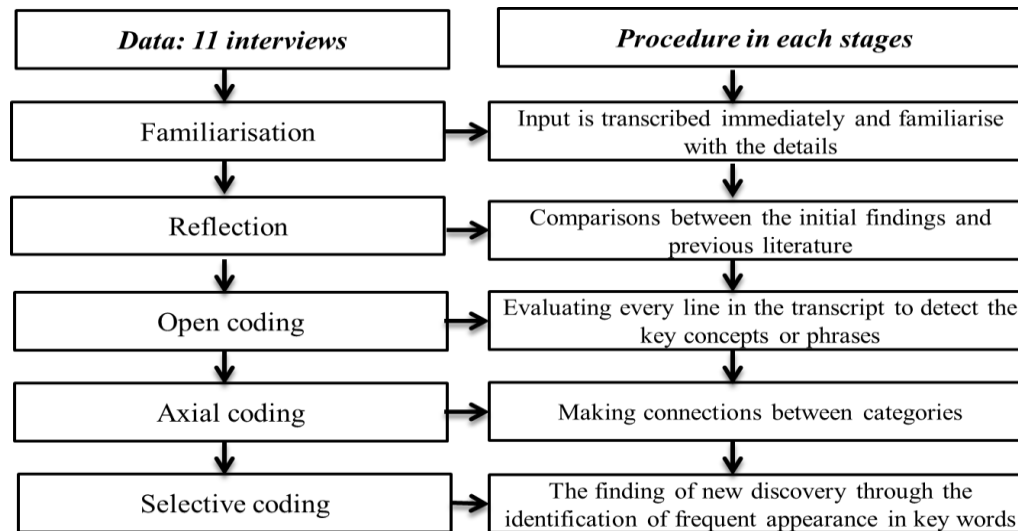


Figure 6.1: The procedure of data analysis in grounded theory
Source: Adapted from Creswell and Amanda (2008)

The familiarisation process needs to start as soon as possible to capture observations during each interview session because they can be helpful to formulate additional questions and revise the main questions for further interview sessions (Glaser 1992). In this research approach, familiarisation with the data assists the researcher to modify questions for further interviews with respondents with different backgrounds and experience.

For example, question A3: *What are the main functions of Malaysian dry ports?* Various answers to this question were received from participants because they had different interests and points of view on Malaysian dry port operations. Thus, familiarisation with answers from the various groups was important to generate follow-up questions for each group.

At the stage of reflection, a cross-case analysis is required. Comparisons were carried out between the initial findings and previous literature or with other cases. This process is to distinguish between existing literature and the current findings to detect the emergence of new ideas (Strauss & Corbin 1997), and also to prevent bias and assist in the achievement of highly precise and consistent findings (Goulding 2005).

Taking question A3 as the example, the answers to this question revealed the function of dry ports in the container seaport system from a Malaysian point of view. The outcome of the reflection process for this question is shown in Table 6.2. There were 14 functions of dry ports identified by the interviewees, compared with four functions from the literature. However, during reflection, these 14 functions have been clustered under four major groups corresponding with the existing literature.

Table 6.2: Reflection process for question A3

Findings during reflection for question A3:	Findings from the literature:
<ul style="list-style-type: none"> • Inland transshipment function • Container transportation function 	<ul style="list-style-type: none"> • Transport function (<i>FDT 2007; UNESCAP 2010</i>)
<ul style="list-style-type: none"> • Customs clearance function • Immigration function • Security function • Express clearance function 	<ul style="list-style-type: none"> • Administration function (<i>Cetin & Cerit 2009; Horst et al. 2011</i>)
<ul style="list-style-type: none"> • Value adding function 	<ul style="list-style-type: none"> • Value-adding function (<i>Song & Panayides 2008; Roso & Lumsden 2010</i>)
<ul style="list-style-type: none"> • Warehouse function • Storage function • Trade function • Barter trade function • Consolidation and deconsolidation function • Container services function • Distribution park function 	<ul style="list-style-type: none"> • Logistic function (<i>Roso & Lumsden 2010; UNESCAP 2010</i>)

Open coding is a formal process of analysis; it is undertaken by evaluating every line in the transcript to detect the key concepts or phrases. Once the key words were detected, code notes were written next to the script. Similar phrases, concepts or key words were labelled and categorised into the same group. The content in each group was transferred to the code form on a card to record key words from the transcript. In this code form, there are some identification details on respondents and notes for reflection. Table 6.3 illustrates an example of the procedure for the coding process, using question A3.

Fourthly, axial coding is a process for identifying the connections between the outcomes from familiarisation, reflection and open coding (Kendall & Judy 1999). Corbin and Strauss (1990) explain that axial coding is a set of procedures to put the data back together in new ways after open coding, by making connections between categories. The information in the categories was constantly re-read to establish the connectivity between them (Eaves 2001).

Table 6.3: Open coding procedure for question A3

<p><i>Question A3 (QA3): What are the main functions of Malaysian dry ports?</i></p> <p><u>Respondent's Code: FIP 1</u></p> <p><i>Original transcript:</i></p> <p><i>'I think they are a representative for ports in a different location. They also help the Industrial Park to export their cargo immediately without any interference from the hectic clearance procedure at ports. Value adding services and warehousing functions are very important for ports to improve competency especially in loading and unloading activities'.</i></p> <p><u>Open coding for QA3:</u></p> <p><i>I think they are a representative for ports in a different location (inland transshipment centre).</i></p> <p><i>They also help the Industrial Park to export their cargo immediately without interference from the hectic customs clearance procedures at ports. (customs clearances).</i></p> <p><i>Value adding services and warehousing functions are very important for ports to improve their competency especially in loading and unloading activities'.</i></p> <p><i>(value adding and warehousing functions).</i></p> <p><u>Code notes FIP 1(QA3):</u></p> <p>In this question, the interviewee emphasised that the functions of dry ports encompass the following points:</p> <ol style="list-style-type: none"> <i>1. An inland transshipment function</i> <i>2. A customs clearances function</i> <i>3. A value adding function</i> <i>4. A warehousing function</i>
--

Finally, at the stage of selective coding, the key words identified will be the central phenomenon, and the frequent repetition of these main phenomena in the data can be merged together (Parker & Roffey 1997). The finding of new discoveries through the identification of frequent appearances of key words will lead to the development of potential themes (Eaves 2001). However, the key words may be identified during open or axial coding and the frequent repetition of these main phenomena in the data can be merged together to develop a theme (Strauss & Corbin 1998). Table 6.4 summarises the axial coding and selective coding process and the development of a final theme for

question A3. The whole outcome of data analysis for the qualitative phase is presented in Appendix B.

Table 6.4: Themes development from the coding process for question A3

Stages	Familiarisation and reflection	Open Coding	Axial Coding	Selective Coding (Final Theme)
Face-to-face interview participants (FIP)				
1, 3, 4, 5, 6, 7, 8, 9, 10 & 11.	<ul style="list-style-type: none"> • Transshipment function • Container transportation function 	<ul style="list-style-type: none"> • Inland transshipment centre • Container distribution/pick up 	<ul style="list-style-type: none"> • Container transportation 	Transport function
1, 2, 3, 4, 6, 8 & 11.	<ul style="list-style-type: none"> • Customs clearance function • Immigration function • Security function • Express clearance function 	<ul style="list-style-type: none"> • Various documentation clearances services at different location 	<ul style="list-style-type: none"> • Documentation clearances 	Administration function
1,4,5,7 & 8	<ul style="list-style-type: none"> • Warehouse function • Storage function • Domestic trade • De/consolidation function • Container service management • Distriparks function • Barter trade function 	<ul style="list-style-type: none"> • Warehouse, storage 	<ul style="list-style-type: none"> • Inland warehouse 	Logistic function
1,4,5,6 & 9	<ul style="list-style-type: none"> • Value adding function 	<ul style="list-style-type: none"> • Product customisation/value adding centre 	<ul style="list-style-type: none"> • Value adding centre for seaport 	Value adding function

6.4 Results and discussion

The interviews undertaken in this qualitative phase have generated 141 items and 53 themes from responses to 12 questions which explore the role of dry ports in the Malaysian container seaport systems. This section discusses the findings for each question that were addressed during the interview sessions including six questions in Section A, two questions in Section B and finally two questions in Section C. The results were presented by the percentage of responses for each question supported by quotes from respective participants.

The significance of the research topic was endorsed by the participants during the interview sessions. Three participants gave their comments on the research as follows:

- *Dry ports are ‘unsung heroes’ in this country. Very few people know about this. It’s important to reveal the real importance of dry ports to the maritime sector in Malaysia. Let them become the real heroes (FIP1).*
- *Finally and surprisingly there will be some research on dry ports in Malaysia. I should thank you for inviting me.... (FIP6).*
- *You know what....we thought that the maritime sector's only focus was on ports.....dry ports are a paradigm shift for the Malaysian maritime sectorI’m happy to assist you (FIP10).*

6.4.1 Roles of Malaysian dry ports in the seaport system

This section discusses the findings for question A1 which asked the participants about the role of Malaysian dry ports. Three roles of dry ports were identified from the analysis, namely an extended seaport, regional intermodal nodes and an interface terminal (see Figure 6.2).

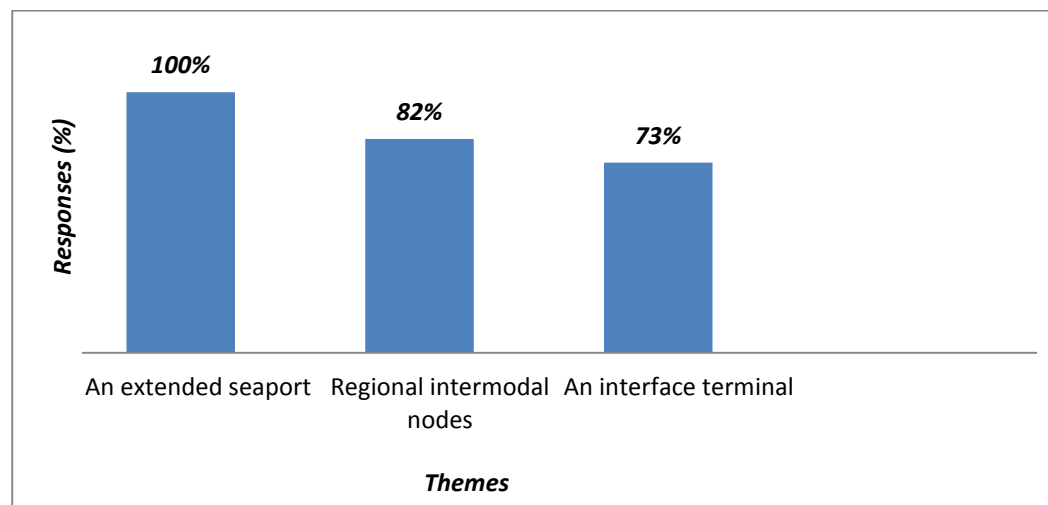


Figure 6.2: Roles of Malaysian dry ports

6.4.1.1. An extended seaport

All participants (100%) indicated that the role of a Malaysian dry port is as an extended seaport. For example, several participants referred to dry ports as an extended seaport comprised of various functions such as a ‘*warehouse function*’ (FIP2), or having a ‘*container storage function*’ (FIP1). Dry ports in Malaysia are believed to replicate seaports, they are located in different areas and provide sufficient volumes of containers to seaports. Participants believed that dry ports facilitate/assist/expedite/simplify seaport activities in the supply chain (all FIPs). This statement indicates that dry ports are known to be a part of the supply chain in Malaysia. In this regard, a comment from one of the participants is notable in expressing this view:

Basically dry ports are an extension of seaport facilities into the hinterland of a seaport, which operate without the presence of shipping activities (FIP7).

It is noted that road congestion near a seaport has an impact on the seaport’s performance. For example, research shows that an increase in road congestion by 1% will reduce seaport throughput by 2.5% (Wan et al. 2013). Dry ports being ‘extended seaports’ can better control and adjust transport flows to match conditions in seaports, as a result, dry ports can help to improve land access to seaports physically (Klink 2000). In Malaysia, Port Klang, Penang Port and Johor are facing road congestion problems which significantly affect the movement of containers from seaports to the hinterland (PWD 2014). Therefore, dry ports can assist in container distribution and increase the accessibility to and from the seaport by reducing traffic congestion by functioning as an extended seaport. This was indicated by an interviewee (FIP5).

Additionally, Rafay and Charles (2011) discovered that transloading activities inland provided an opportunity for dry ports to assist clients in gaining time and cost benefits.

The findings from the interview were similar to this. For example, FIP4 commented that *‘the role of Malaysian dry ports as an extended seaport ensures the sustainability of throughput at seaports and flawless container transportation activities to and from the land (hinterland)’*.

6.4.1.2. Regional intermodal nodes

About 82% of the participants agreed that Malaysian dry ports are regional intermodal nodes and crucial for regional development. For example, FIP2 clarified that *‘dry ports are a regional centric/based/oriented entity and responsible for a nation’s economic growth’*.

Northern and east coast regions of peninsular Malaysia have been left behind in economic development compared to the west coast region (Naidu 2008). A participant (FIP6) commented that *‘dry ports as regional intermodal nodes are required to balance the economic development in peninsular Malaysia’*. Additionally, FIP4 stated that *‘dry ports play a role as inland transshipment ports especially to deliver and collect containers from seaports to and from Thailand and Singapore and are anticipated to enrich the economic development in our region (northern region)’*. Consequently, the existence of northern and southern freight corridors can be facilitated by utilising dry ports for the purpose of inland transshipment activities.

6.4.1.3. An interface terminal

Seventy three percent (73%) of the participants agreed that Malaysian dry ports play a role as an interface terminal inland. Four participants (FIP2, FIP4, FIP5 & FIP8) indicated that dry ports are a platform for an interface between rail and road transportation. Another four interviewees (FIP1, FIP3, FIP6 & FIP7) indicated that dry ports as an interface terminal

inland improving the utilisation of rail freight in Malaysia by implementing multimodalism for container freight distribution.

The benefits of multimodalism for dry ports include increasing the frequency of trips, assisting the punctuality of delivery and maintaining high consistency in transport mode interchange (Stanton et al. 2013). Therefore, dry ports are expected to increase the consistency of freight trips between seaports and dry ports as an interface terminal inland for rail and road transportation.

In addition to being an interface for multimodal transportation, dry ports are identified by 55% of participants as being an interface between seaports and manufacturers. The participants said that dry ports have become a platform to connect seaports and manufacturers inland which increases the proximity between them. The opinions from the participants in this regard are summarised below:

- *Dry ports are a transit terminal for small and medium industry (FIP4).*
- *Dry ports are the same entity as seaports but are located near manufacturers. It is an advantage of the manufacturer to obtain their required services at any time (FIP6).*
- *Dry ports are an additional facility for facilitating the manufacturer inland during trade procedures (FIP8).*

Dry ports benefit from being located near a manufacturing area or an industrial park. On the other hand, they assist most manufacturers in facilitating freight movement within the seaport system. This role of dry ports is significant, especially in assisting manufacturers located in states without container seaports. These states include Malacca, and Seremban

in the central region, Perlis and Kedah in the northern region and Kelantan in the east coast region.

Globally, the main roles of dry ports are as extended gateways for container seaports, as integrators of intermodal transport system, as freight platforms, and as an entity that promotes regional economy development (Visser 2006; Roso & Lumsden 2009; Rodrigue & Notteboom 2009). Despite the different terms used to classify the roles of dry ports in Malaysia, the mission of each role is harmonised within the role of dry ports in other regions worldwide.

6.4.2 Objectives of dry ports

This section discusses the findings for question (A2) which asked the interviewees about the objectives of dry ports. There were five main objectives discovered, including accelerating national and international trade, activating intermodalism in the nation, improving seaport competitiveness, enhancing regional economic development and establishing Malaysian port policy (see Figure 6.3).

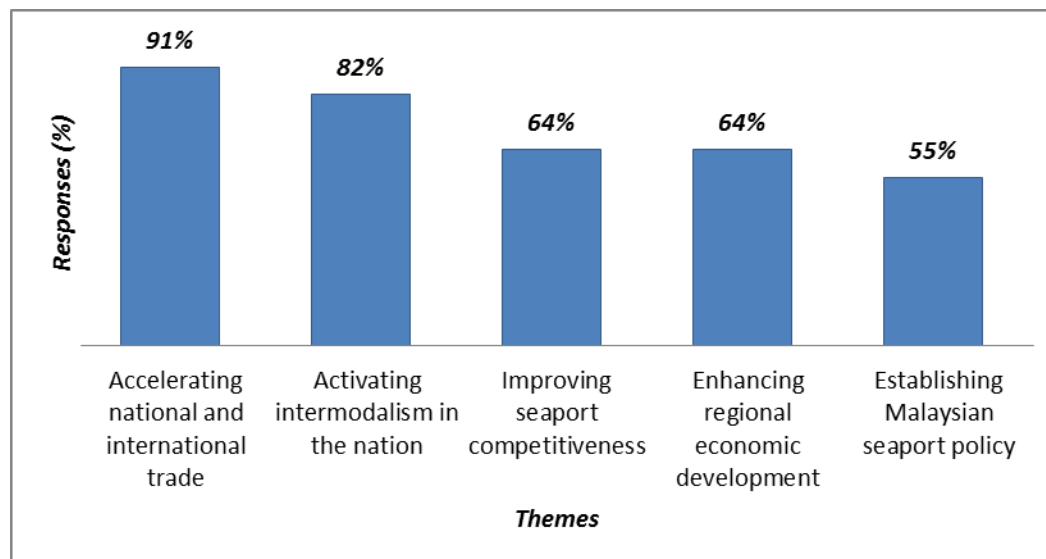


Figure 6.3: Objectives of Malaysian dry ports

6.4.2.1. Accelerating national and international trade

About 91% of participants agreed that a major objective of Malaysian dry port development is to accelerate national and international trade. The following two comments were participants' views related to this objective.

- *The objective of this terminal is to increase the volume of domestic/local containers from all regions in peninsular Malaysia to and from container seaports (FIP10).*
- *Dry ports increase the container volume from international border transactions between neighbouring countries, especially Thailand, Singapore, Cambodia and Myanmar with Malaysian seaports (FIP5).*

As a seaport operator participant indicated, the coverage of the four dry ports from north to south Malaysia strengthened the trade between and within the nation. This is because of their perpendicular location at Padang Besar, Ipoh, Nilai, and Segamat and their linkage with road or rail facilities to national regions (FIP7).

Thailand and Singapore are the main trading partners of Malaysia, so the existing dry ports, especially located at borders such as PBCT and SIP, are an added advantage for fast and effective crossborder transactions (Chen et al. 2015). For example, a comment from a seaport authority (FIP1):

The manufacturers from the southern part of Thailand prefer using the PBCT dry port as an intermediate to Penang Port rather than Bangkok Port because the distance to Penang Port is shorter than that to Bangkok Port in southern Thailand.

The above findings strongly support the objective of dry ports as being able to accelerate national and international trade.

6.4.2.2. Activating intermodalism in the nation

About 82% of the participants stated that another objective of dry ports is to activate intermodal transportation. Integration of dry ports in freight corridors and linking to seaports through road and rail activates intermodalism for the nation. As per the comment from FIP7 presented in 6.4.2.1, the location of Malaysian dry ports and their linkage with road or rail facilities to national regions facilitates the nation's intermodalism. In addition, as a dry port operator (FIP2) stated:

There are lacks of facilities that transport the container from southern Thailand to Bangkok Port. PBCT is the only dry port connecting southern Thailand and northern Malaysia with road and rail transportation. This is the most active channel encouraging inland trade activities between these regions.

This statement shows that a dry port located at the border contributes to the intermodalism within an international region.

6.4.2.3. Improving seaport competitiveness

Around 64% of the participants indicated that a dry port is an important node for enhancing container seaport competitiveness. Participants revealed four main points on how dry ports contribute to seaport competitiveness.

- *Dry ports improve seaport efficiency (FIP4 & FIP8).*
- *Dry ports enhance seaport effectiveness (FIP9 & FIP10).*
- *Dry ports provide sufficient space for containers at seaports (FIP1& FIP2).*
- *Dry ports reduce seaport congestion (FIP11).*

The participant from the seaport authority (FIP1) mentioned '*additional space in ICT as well as adequate multimodal transportation provides additional capacity to Port Klang and Penang Port*'. The opinion from (FIP1) was seconded by a participant from a seaport operator (FIP10) who stated '*additional space is required at seaports to improve their congestion and to provide effective and efficient services to the clients*'. This finding aligns with other country's experience that dry ports are used to overcome capacity constraints at seaports. For example, the Port of Virginia in the United States optimises the Virginian Inland Port to assist its operation because the inland port has space availability and a range of transportation options (Bruce et al. 2013).

6.4.2.4. Enhancing regional economic development

Sixty-four percent (64%) of the participants indicated that the development of Malaysian dry ports has contributed to regional development. Malaysian dry ports perform as '*container consolidation and deconsolidation parks for several states in Malaysia without container seaports, and located far from the main seaports*' (FIP4). In addition, FIP5 stated:

Dry ports execute container collection functions to their nearest states such as Malacca, south Selangor, Seremban and northern Johor. These states are renowned as manufacturing areas for electronic parts, food and agricultural products'.

The findings show how dry ports enhance transactions between states through assistance in managing regional cargo to be distributed to seaports for export.

As Rodrigue & Notteboom (2009) indicate, the presence of dry ports creates jobs in the road haulage industry and other subsidiary industries that are related to dry port operations (Rodrigue & Notteboom 2009). In this research, results revealed that dry ports contribute to regional development by increasing employment rates. Three participants (FIP1, FIP2 &

FIP3) provided evidence indicating that the existence of PBCT, for example, has increased employment opportunities for the state. As FIP2 commented:

Perlis located on the northern tip of Peninsular Malaysia and close to southern Thailand is a low economic development state. The indirect impact of the dry port on increasing regional job opportunities has enhanced the economic development of this region'.

Therefore, the findings of this research regarding the contribution of dry ports to job opportunities are consistent with that found elsewhere in the literature.

Dry ports are able to attract investments for themselves and to the region where they are located, resulting in enhancing regional development. To develop dry ports in a region, some conditions need to be considered so that any developed dry port can contribute to economic regional development. These conditions include the existence of economic activities, physical infrastructure and connectivity (Rodrigue 2004). In Malaysia, the PBCT is a good illustration for the above argument. One participant (FIP5) said that *'the development of PBCT, equipped with multimodal options has intensified additional investment in the dry port'*. Additionally, FIP11 seconded this statement by saying that *'the main source of investment will be generated from international and national freight corridors such as the Indonesia-Malaysia-Thailand network (IMT-GT) and the northern corridor economic region (northern freight corridors)'*. Hence, the availability of PBCT in the northern freight corridor is an initial stage in attracting investors to invest in this region and to grow economic activities in addition to agriculture. Moreover, the location of PBCT in the freight corridor ensures that the optimal use of transport infrastructure enhances local trade and the economy. This is similar to the case of an international experience i.e. at the Mandalay Dry Port in Myanmar (Black et al. 2013).

6.4.2.5. Establishing Malaysian seaport policy

Around 55% of participants identified that the development of dry ports is important in establishing the national seaport policy. Policies such as developing and utilising seaport facilities, improving the efficiency of seaport operations, promoting multimodalism, developing seaport ancillary services and improving hinterland transportation are key aspects in national seaport policy (Mak & Tai 2010). Six of the participants (FIP1, FIP3, FIP5, FIP7, FIP8 & FIP9) indicated that the development of dry ports in the seaport system has triggered the effectiveness of seaport policy by improving inland transportation infrastructure in the region.

A rail operator participant (FIP3) commented that *‘facilities and infrastructure in dry ports need to be optimised to improve the seaport-dry port network’*. The participant’s view was similar to the strategy implemented in the Southeast Drenthe Dry Port in the Netherlands, where investment in a dry port included rail link development and was given the utmost priority prior to the seaport investment (Visser et al. 2009). Through this strategy, various policies have been achieved including the promotion of multimodalism, an improvement in hinterland transportation and the enhancement and utilisation of seaport facilities.

6.4.3 The functionalities of Malaysian dry ports

This section presents and discusses the findings for question A3 which asked the interviewees about the function of dry ports in the container seaport system. The results indicated that there are four main functions for Malaysian dry ports, namely transport, logistic, administration and a value adding function (see Figure 6.4).

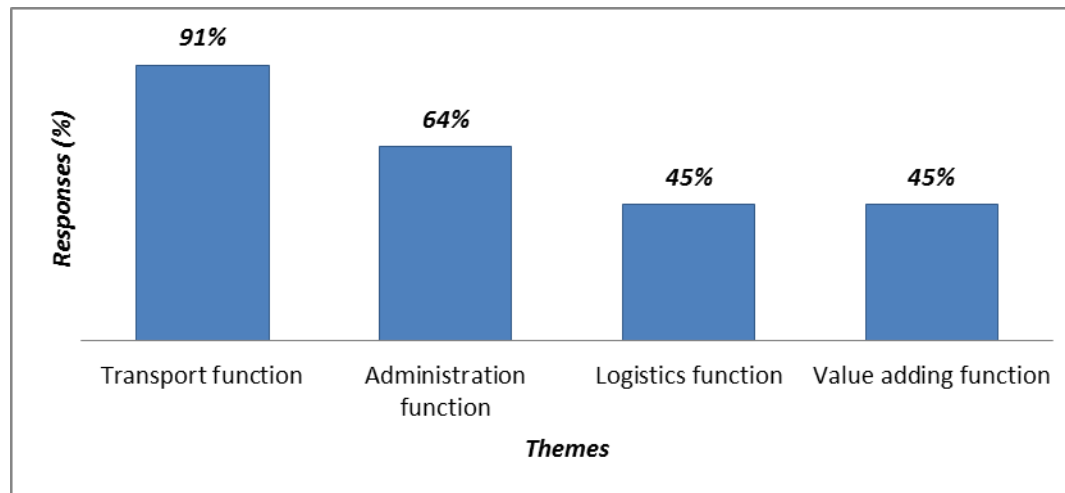


Figure 6.4: Functionalities of Malaysian dry ports

6.4.3.1. The transport function

Ninety-one percent (91%) of the participants asserted that dry ports are mainly for performing a transport function. Most Malaysian dry ports play a critical role in connecting seaports and manufacturing inlands (FIP4). They facilitate door-to-door services for containers delivered to or picked up from seaports (FIP3, FIP4, FIP5, FIP7, FIP8 & FIP11). For example, a participant (FIP3) stated that the ICT dry port connects to Port Klang by rail and road. It provides 6 train trips per week to Port Klang with a capacity of 480 TEUs per week, while road transport is via North-South Highway to Port Klang. This participant believed that it reduces container dwelling time in terminals, decreases inland transportation costs, and increases shippers' connectivity to the seaports. As presented in section 4.5 of Chapter Four, the volume of containers contributed by dry ports including PBCT, ICT and NIP is evidence that dry ports function as a transshipment centres performing the transport logistic function to connect manufacturers and seaports.

6.4.3.2. The administration function

Sixty-four percent (64%) of the participants identified the fact that dry ports also play an administrative function. According to the view of seven participants (FIP1, FIP2, FIP3,

FIP4, FIP6, FIP8 & FIP11), these functions include customs clearance, immigration and police inspection for domestic and international containers distribution. The following statement from a dry port participant shows the importance of administration as a function of a dry port.

The combination of services including customs, immigration and police inspection is highly expected by clients in dry ports to transfer and receive their valuable containers beyond the region legally and safely (FIP6).

In addition, four dry port participants (FIP2, FIP4, FIP6 & FIP8) declared that currently the four Malaysian dry ports provide a customs clearance service to their clients to assist seaports in managing container movement. By doing so congestion and capacity constraints at seaports can be overcome (UNESCAP 2012).

It is noted that cargo smuggling is one of the main concerns at the Malaysian-Thailand border (FIP1). Therefore, the border dry port is required to perform an immigration and quarantine examination strictly. As indicated by a participant from a dry port:

The stricter immigration service is required at PBCT to permit access for haulier drivers from Thailand to Malaysia. The immigration service is required to ensure the drivers and the containers from Thailand are legitimate to enter Malaysian territory (FIP2).

Dry ports assist container seaports in focusing on primary activities, namely container transloading and transshipment, without contributing excessive amounts of time for customs clearance and inspection in the seaports' territory (FIP6). Therefore, dry ports can benefit seaports by managing cargo movements more efficiently.

6.4.3.3. The logistic function

Forty-five percent (45%) of the participants revealed that dry ports provide logistic functions in inland. Five participants (FIP1, FIP4, FIP5, FIP7 & FIP8) confirmed that these logistic functions were a warehousing function, storage function and de/consolidation function. For example, a participant (FIP5) stated that *‘performing a warehousing function and a storage function at dry ports allocates additional space for the North Port to contain a Vehicle Transit Centre (VTC), and it increases the container volume in this seaport’*. These views of participants are similar to the experience of dry port operations in China, in that the dedication of dry ports to logistic functions such as container de/consolidation intensifies the annual volume of containers (Shi 2009).

On the other hand, not all Malaysian dry port spaces are used effectively for performing logistic functions. Two participants FIP7 & FIP8 advised that the space available at SIP remains underutilised. Hence, it will be necessary to optimise the use of space there and increase the capacity of the North Port because it will enhance container throughputs at the North Port. This finding shows that the involvement of a dry port in providing logistic functions in the hinterland benefits both seaports and dry ports.

6.4.3.4. Value adding function

Forty-five percent (45%) of participants further agreed that dry ports perform value adding functions. Value adding functions that are undertaken by dry ports include assorting, mixing, blending, packaging and repackaging, labelling and relabeling, offering tailored services beyond the standard offer, exporting packaging for transport requirements, offering disposal services, container weighing and services, and giving product advice to consignees and distriparks (FIP1, FIP4, FIP5, FIP6 & FIP9). Participants also expressed

their views on the benefits of providing value adding services at dry ports in the following comments.

- *Variations and the latest value adding services increase the demand for dry ports among their clients (FIP1).*
- *Moving non-maritime seaport activities to dry ports such as value-adding production have been encouraged by the government in order to improve traffic congestion in the nation (FIP9).*
- *Forwarding services, brokerage and transportation advice is really needed by the clients from NIP to facilitate the voyage of containers in the transport chain around the state of Malacca, southern Selangor, Seremban and northern Johor (FIP6).*
- *Manufacturers from these zones (the central zone) utilise services provided by dry ports to obtain cost and time advantages which are very critical elements for manufacturers (FIP6).*

Of notice is that not all dry ports in Malaysia provide sufficient value adding services to their clients. For example, a seaport authority participant (FIP1) outlined *‘the intention of PBCT dry port to provide a range of value adding services on behalf of the seaport has not been achieved. We (the seaport) are expecting even more from them (the dry port)’*.

In contrast, two officials from dry ports (FIP4 & FIP6) expressed that NIP and ICT linked to all major seaports provide a range of services to clients, such as packing and labelling of cargo as well as service advice to the consignee.

For further exploration, a follow-up question was given to seaport authority and government official participants about the efficiency on value adding function at NIP and ICT. They (FIP1, FIP5 & FIP9) declared that these two dry ports provide extensive value adding functions to seaports and that they are really favourable to the clients. Two

participants (FIP1 & FIP9) suggested that the two other dry ports (PBCT and SIP) should take a lesson from this and follow procedures parallel with ICT and NIP dry ports.

6.4.4 Users of Malaysian dry ports

During the interviews, participants were asked to identify key users of dry ports (question A4). The findings showed that there are six groups of users, namely freight forwarders, shippers, the rail operator, seaports, hauliers and manufacturers. Among them, freight forwarders are the main user, expressed by 82% of participants, followed by shippers (64%), rail operators (55%), seaport operators (45%) and hauliers (45%). Only 27% of the participants indicated that international and domestic manufacturers use dry ports. The reason for this may be that they use freight forwarders to manage their cargo rather than being directly involved in operating cargo shipment operations themselves.

Understanding the key users of Malaysian dry ports is important, since their views on dry port operations can be drivers for further improvement in service provision by them. The information obtained from the interview helped the researcher target key user groups for sampling and distributing questionnaire surveys conducted subsequently in the quantitative phrase of this research, aiming to acquire their views on influential factors in Malaysian dry port operations.

6.4.5 Benefits of Malaysian dry ports

Interview participants were asked about what benefits Malaysian dry ports can bring in terms of time and cost for seaports and their stakeholders by managing cargo transported to and from seaports (question A5). Of interest is that the interviewees expressed that there are more benefits than time and cost. These include reducing waiting times at

seaports, providing an effective clearance system, decreasing freight costs, facilitating crossborder transactions and reducing empty container movements.

6.4.5.1 Reducing waiting times at seaports

About 91% of the respondents agreed that dry ports reduce waiting times at seaports. This is because utilising space that is available at dry ports helps seaports gain more space capacity for operations and increase container volume through services such as customs clearance, provision of space for laden and empty containers, valued adding activities and transport connections (FIP3, FIP4, FIP5, FIP6, FIP7, FIP8, FIP9 & FIP10). As a result, berth efficiency improves, resulting in increased numbers of vessels calling at seaports (FIP10). In addition to reducing waiting times for berth, using dry ports also helps to reduce waiting times for trucks at seaports (FIP4). The connection between seaports and dry ports enhances the rapidness of container transloading activities, which not only reduces turnaround time of vessels at seaports (FIP1, FIP2 & FIP7) but also reduces the risk for demurrage charges (FIP7).

6.4.5.2. Providing clearance systems

About 82% of the respondents expressed that another benefit of having dry ports is that they provide clearance procedures inland. The following are some comments in this regard from interview participants.

- *The clearance procedures at a dry port are the same as that at seaports, and reduce clearance activities at the seaport. They used to be time consuming and created congestion at inbound/outbound gates (FIP6).*

- *Dry ports avoid long customs clearance times at seaports. We are not applying double clearance procedures because we trust them (dry ports) and they have the authority to proceed with clearance procedures outside seaports (FIP1).*
- *Less documentation procedures at seaports reduce time consumption and most importantly prevent congestion, especially at the gates during peak hours and seasonal times (FIP10).*

In summary, having customs clearance procedures at dry ports contributes to a reduction in the time cargo stay at seaports.

6.4.5.3. Reducing freight costs

Eighty-two percent (82%) of the respondents expressed that the existence of dry ports helped to reduce total freight costs. For example, a participant (FIP7) stated that ‘*the incorporation of multimodal transportation at the dry port has managed to reduce the freight costs and reduce the market price of cargo/goods at the destination*’. However, two participants (FIP3 & FIP9) from the railway and Ministry of Transportation questioned this and mentioned that this benefit can only be achieved if the Malaysian railway network is equally established as road transportation for peninsular Malaysia, and that the clients are willing to utilise rail facilities for container transportation. The comment shows that it is necessary to significantly reduce freight costs by utilising dry ports improving multimodal freight transportation.

6.4.5.4. Facilitating cross border transactions

About 64% of the respondents claimed that facilitation for cross border transactions is another benefit of dry ports. Seven participants from seaports, dry ports and government agencies (FIP1, FIP2, FIP6, FIP8, FIP9, FIP10 & FIP11) declared that dry ports have the

capacity to improve cross border transactions between Thailand, Malaysia and Singapore. Three participants (FIP1, FIP2 & FIP9) mentioned that the development of cross border transactions between these three countries increased trade in perishable goods and cold-chain transactions between them. As stated by a participant from the Ministry (FIP9) '*dry ports need to take advantage of freight corridors at borders, such as northern and southern freight corridors to facilitate the clients for crossborder transactions*'. The findings imply that utilising Malaysian dry ports close to the border can enhance trade with other nations in its region.

6.4.5.5. Reducing empty container movements

Roso et al. (2009) argue that dry ports have been anticipated to provide space for empty container storage. This phenomenon has been observed in Malaysia, and it results in a reduction in travel of empty containers. The interview results revealed that 45% of the participants mentioned that decreasing empty container movement on the road is another benefit from dry ports. Five participants (FIP3, FIP5, FIP6, FIP8 & FIP10) expressed the fact that the space provided by dry ports for empty containers has reduced the movement of hauliers with empty containers to seaports.

Two dry port operator participants (FIP6 & FIP8) mentioned that the space at dry ports for empty containers is in high demand because of the greater convenience and better charges offered than that at seaports. Interestingly, a participant from a seaport (FIP10) had a similar view as the above comment and stated '*the dry port reduces empty container movement on the road by providing convenient services, spaces and low charges, which are more attractive than seaports*'. Participants (FIP3, FIP5, FIP6, FIP8 & FIP10) pointed out that this benefit had resulted in an improvement in road congestion especially in metropolitan cities including Kuala Lumpur in central Malaysia, and Johor in the south.

6.4.6 Requirements for Malaysian dry port operations

This section presents and discusses participants’ answers to question A6 which explored the requirements necessary for Malaysian dry port operations. There are three major themes identified as key requirements for Malaysian dry port operations, namely, operational infrastructure, personnel requirements and capital infrastructure (Figure 6.5).

6.4.6.1 Operational infrastructure

About 91% of the participants indicated that operational infrastructure is the most vital requirement for operating a dry port. Ten participants (FIP1, FIP2, FIP4, FIP5, FIP6, FIP7, FIP8, FIP9, FIP10 & FIP11) considered operational infrastructure as being a basic requirement for dry port performance in the container seaport system.

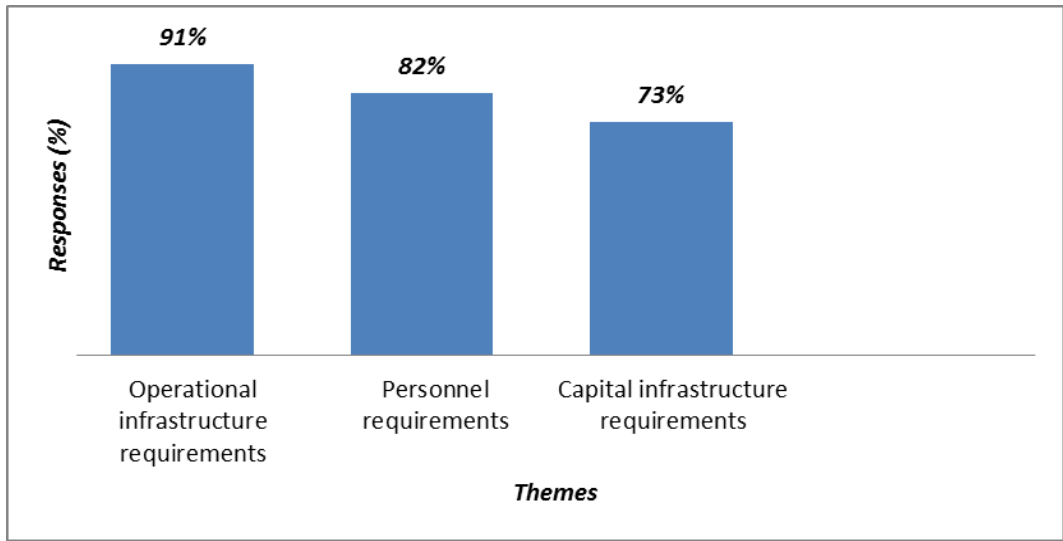


Figure 6.5: Requirements for Malaysian dry port operations

They suggested three requisites in relation to operational infrastructure: primary requisites, important requisites and miscellaneous requisites. Participant views on relevant operational facilities and equipment corresponding to each requisite are summarised below.

- *Primary requisites: a container yard, customs, rail and truck access, rail siding, express clearance lane, immigration and quarantine check (FIP4, FIP5, FIP6&FIP7).*
- *Important requisites: a weigh bridge, a truck parking bay, a cargo consolidation yard, external and internal road and stacker cranes (FIP1&FIP2).*
- *Miscellaneous requisites: bonded and non-bonded warehouses, stuffing and unstuffing yards, empty container repair yards, a clearance agent's office, a police station, a fire station, a security office and a cafeteria are required in dry ports (FIP8, FIP9, FIP10 &FIP11).*

A lack of the above requisites may have negative impacts on container supply chains. This is evident with an example illustrated by a participant from the seaport authority (FIP2). He indicated that the PBCT is suffering from insufficient operational infrastructure especially in machinery, such as tractor-trailers, rubber-tired gantries and rail-mounted gantries, for container lifting and manoeuvring. This situation has led to slow productivity, delays, and inefficient container arrangements on the railway deck heading to Penang Port from southern Thailand. In turn, customer satisfaction has been impacted (FIP2).

6.4.6.2 Personnel requirements

About 82% of participants considered human resources to be critically important for Malaysian dry port management and operations. Nine participants (FIP1, FIP3, FIP4, FIP5, FIP6, FIP7, FIP8, FIP9 & FIP11) indicated three main categories of professional staff required for operating dry ports, namely warehouse staff, yard staff, and safety and security staff. The opinions from the participants are revealed below.

- *Warehouse staff: the most important human resource to manage bonded and non-bonded warehouses at dry ports (FIP5, FIP6, FIP7 & FIP8).*

- *Yard staff: professional personnel in the container yard, consolidation, container repairing, a physical check officer, an express clearance lane officer, truck parking bay managers and stacker crane operators (FIP1, FIP3&FIP4).*
- *Safety and security staff: including customs officers, immigration and quarantine officers, health inspectors, security officers, police officers and fire fighting officers are required for clients to select their dry ports to ensure all cargo are transported and managed without any significant risk until they reach their destination (FIP9 &FIP11).*

Two seaport operators (FIP1 & FIP11) said that limited and inexperienced yard staff at the dry ports of SIP and PBCT are one of the main hindrances to operational efficiency. They urge dry ports to improve their skilled workforce through training and exposure for all staff at dry ports. Another participant from the Ministry of Transportation (FIP9) further suggested strategies for strengthening the skill of the dry port workforce. He said:

We may offer a cross-practical internship (with pay and training allowances) between staff from seaports and dry ports to understand clearly the environment, procedures and critical requirements during operations in both organisations. (FIP9)

Participants' comments on the need of a skilled workforce imply that successful dry port management and operations rely on a highly skilled workforce undertaking various jobs and tasks. The Poznan Dry Port in Poland is a good example of this at work; its professional workforce is able to garner and distribute all the information about the destination or origin of containers, modes of transportation and vessel schedules at seaports despite it suffering from insufficient railway tracks, poor connectivity with the container catchment area and limited road access to container terminals (Trainaviciute 2009).

6.4.6.3 Capital infrastructure

About 73% of the participants expressed that there is an urgency to improve capital infrastructure at dry ports, in particular transportation infrastructure. The finding shows that capital infrastructure is critical to Malaysian dry ports.

In this regard, eight participants (FIP1, FIP2, FIP3, FIP5, FIP7, FIP8, FIP9 & FIP10) from various organisations expressed the fact that transportation infrastructure is the most vital component in the capital infrastructure for improving seaport and dry port performance. Transportation infrastructure such as access to tracks, rail sidings, internal and external road infrastructure have been mentioned by participants. Transportation infrastructure affects dry port accessibility and connectivity to seaports, and as a result dry port productivity and throughput may be affected. For example, Amal Dry Port in Sweden faced severe challenges in seaport accessibility, connectivity, and infrastructure limitations, which caused a low record of throughput (Woxenius & Bergqvist 2010).

6.4.7 The strength of Malaysian dry ports

This section discusses the findings for question B1 which asked the participants about the strength of Malaysian dry ports. There are three type of strengths discovered from the existing dry ports, namely the location of dry ports, the involvement of public and private partnerships and transport connectivity (see Figure 6.6).

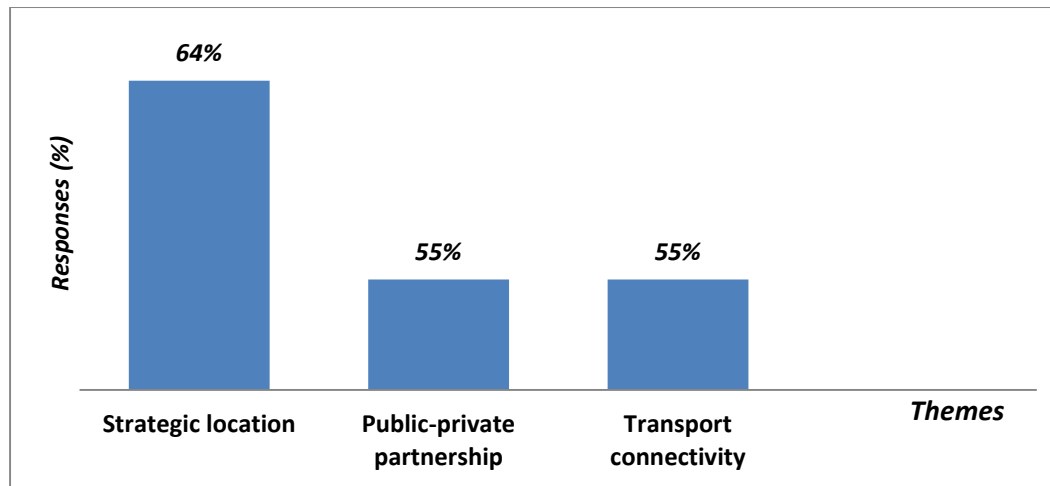


Figure 6.6: Strength of Malaysia dry ports

6.4.7.1 Strategic location

Sixty four percent (64%) of the participants agreed that strategic location is the key strength of Malaysian dry ports. Seven participants from seaports, dry ports, railway and government bodies (FIP1, FIP2, FIP3, FIP5, FIP6, FIP7& FIP11) declared that the location of dry ports scattered perpendicularly (vertically located from north to south) is the most important forte of these terminals. The participants provided various perspectives with regard to dry port location. The opinions are summarised as follows:

- *The dry port location is supported by logistical connections to origins/destination as far north as Bangkok and Singapore in the south (FIP2).*
- *Malaysia possesses dry ports at the borders (PBCT and SIP) and two dry ports next to the main cities, such ICT in Ipoh and NIP in Seremban (FIP3)*
- *Dry ports at borders promote cross border transaction between Thailand-Malaysian-Singapore (FIP6).*
- *Dry ports in city areas facilitate local clients in trade procedures by providing customs clearances, scanning, haulier services and value adding services (FIP11).*

The strength of Malaysian dry ports from a location perspective is that they promote economic development for the state. Five participants (FIP2, FIP3, FIP4, FIP6 & FIP9) pointed out that dry ports are able to generate and attract new industries around dry ports. Several opinions from the participants in this regard are summarised below:

- *This dry port (NIP) was established in 1995. Before this time, there were only a few manufacturers around us. After 1995 and until 2014, there were almost 200 hundred manufacturers of different sizes located within 10 kilometres of this dry port. They are here (manufacturers) because we are here to assist them* (FIP6- a dry port operator).
- *The development of this dry port (NIP) boosts the development of the economic zone such as Senawang, Sungai Gadut (FIP3), Nilai, Tunku Jaafar Industrial Park (FIP6) and Port Dickson (FIP9).*
- *These terminals (ICT and PBCT) have the strength to balance economic development in these states, improve job opportunity and boost transport linkage development. Before this dry port commenced, this state (Perlis) was highly dependent on agriculture and now we can see a lot of transport companies developed around us. It's a good sign of economic diversity* (FIP2-a dry port operator).
- *As you know, this state is known for tin products. This dry port (ICT) creates economic difference by introducing a terminal in the middle of the city. Now, we transport these tins to Port Klang. We are happy to integrate the function of this terminal within our traditional industry* (FIP4-a dry port operator).

Dry ports in Malaysia significantly attract new industries to grow around them and expand the diversity of economic development. Moreover, these dry ports manage to incorporate with traditional business in this region and provide value adding logistic services for effective transportation from and to seaports.

6.4.7.2 The involvement of public and private sectors

A total of 55% of the participants declared that the equal involvement of the government and the private sector is a strength of Malaysian dry ports. Six interview participants provided details about the various sectors that have invested in the dry ports, summarised below.

- *The main investors for the PBCT dry port are the operators of Penang Port and Port Klang Authority (FIP1).*
- *For the ICT dry port, Port Klang, Johor Port (authority), Penang port (operator), State government (state of Perak) and Malaysian railway (FIP4) are involved.*
- *The shareholders of the NIP dry port are the State government (State of Seremban), Complete Logistics (a private company) and Port Klang (authority) (FIP6).*
- *The main investors in SIP dry ports are from Malaysian railway, Johor Port (authority), Port Klang (authority) and the State government (state of Johor) (FIP8).*

In addition to these comments, an official from Malaysian railway (FIP3) said:

The incorporation of public and private strategy is branded as corporations where, government bodies encourage the involvement of the private sector mainly to support the development of the organisation financially. These joint-stock organisations are expected to be flexible, customer oriented, and become an additional strength for dry ports.

The involvement of the public and private sectors in the seaport sector started in 1986 when Port Klang was first privatised in Malaysia. The cooperation between the public and the private sectors was applied to dry port development to secure financial support and steady regulation procedures from both parties.

The involvement of public and private sectors in dry port operations needs to be established to generate benefits for seaports and dry ports. All seaports are the main investors in dry ports and this has become the main strength for both entities performing efficiently in the container seaport system. The combination of public and private sectors provides strength for seaports and dry ports in planning, developing and executing effective strategies to utilise freight corridors and multimodal transportation, transforming their domination of the east coast of the peninsular and expanding their network to Singapore and Thailand for collective benefits.

6.4.7.3 Transport connectivity

About 55% of the respondents declared that another strength of Malaysian dry ports is transport connectivity. In Malaysia, transport connectivity and the location of dry ports are complementary to each other. Sufficient transport connectivity in Malaysia may change the perception of dry ports which are not strategically located and exposed to competition, which then become strategic and manage to overcome their competition. According to FIP1 & FIP2, there is a transport time advantage especially for border based dry port provision, where the time advantage is less than 6 hours from the southern Thailand catchment zone to the PBCT dry port. They mentioned that the trip from the southern Thailand catchment zone to Laem Chabang, Bangkok seaport took around 9 hours. The PBCT dry port provides a 3 hour time advantage to its clients especially from Thailand.

An interview participant (FIP4) commented in the following way, *‘the customers at this dry port (ICT) enjoy fast container transportation from the location of the manufacturers to the seaport via the dry port’*. A participant (FIP3) added *‘the dry port keeps in touch with the manufacturer and collects the containers when they are ready, prior to shipment, and they save valuable time’*. Furthermore, two interviewees (FIP9 & FIP11) indicated that

that faster container transportation by road and rail reduces hectic conditions that manufacturers can face through congestion at seaports which cause great delays for the shipment.

6.4.8 Challenges in Malaysian dry ports

The findings from question B2 indicated that there are five challenges identified from existing dry ports. These include transportation infrastructure and operation, container planning, competition, location of dry ports and the community (see figure 6.7).

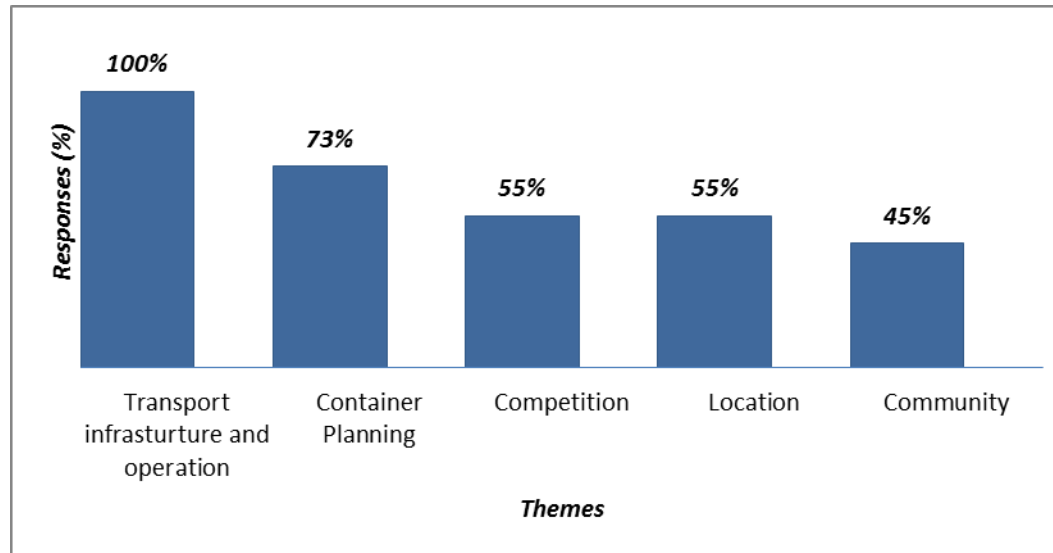


Figure 6.7: Challenges of Malaysian dry ports

6.4.8.1 Transport infrastructure and operation

All participants (100%) stated that the infrastructure and operation of transport is the main challenge faced by dry ports, in particular rail transportation. Insufficient railway track is the main issue faced by Malaysian freight transportation (FIP3). A dry port operator participant (FIP2) indicated that dry port operators are not satisfied with the single railway track and limited coverage to all regions in peninsular Malaysia. This limited coverage is not productive for dry port operations. This is the main reason why dry ports are not yet

able to provide a significant contribution to seaports in improving their capacity and trade volume in Malaysia.

In respect to transportation services, almost 82% of the participants expressed that the limited frequency of rail services and constraints on rail freight capacity are other issues faced by dry port operations. For example, a dry port operator participant (FIP4) stated:

The single railway track and limited frequency of the train are not economic to the PBCT because this dry port faces a high volume of containers from Thailand. The limitations slow down the container transportation to Penang Port and produce a space limitation and traffic congestion at PBCT.

Regarding capacity, the rail operator FIP3 identified the fact that the Malaysian railway system has the ability to carry 60 TEUs per trip and conduct six trips in a week. However, this capacity is not sufficient to accommodate the high volume of inbound containers from the customers at PBCT. Of notice is that the dry port SIP located near Singapore is unable to utilise the advantage of a border dry port due to the unavailability of a rail network for freight transportation between Malaysia and Singapore (FIP8).

Sufficient rail frequency has the potential to reduce train and container turnaround times as well as gain additional confidence among the clients in utilising the railway network to dry ports (Kunaka 2013). The insufficient rail service and infrastructure in the Malaysian freight system has resulted in a high dependency on road transport. Therefore, how to increase rail services between dry ports, seaports and hinterlands should be considered.

One of the pre-requisites for dry port operation is the existence of multimodal transportation (Roso & Lumsden 2010). However, the NIP dry port has no railway connection and depends only on road transportation (FIP3), which affects service quality (FIP6). The use of road haulage as the main mode of transportation produces more

environmental issues such as air and noise pollution as well as increased traffic congestion in the seaport area.

In addition, Malaysian dry ports have faced the challenge of short distance delivery. The ICT dry port faces a challenge in directing some of its containers to zone 1, less than 20 kilometres from the dry port, because most of the haulers prefer long trips to zone 2 or 3, i.e. 20-30 kilometres and above 30 kilometres from the dry port (FIP4). Compared to other dry ports, ICT is the only dry port connected to all major container seaports. However, if such issues cannot be solved, they will affect the efficiency of dry port operations.

In summary, the finding of an insufficient rail service and its low capacity causes a heavy reliance on road freight transportation and implies an imbalanced development of modal split between road and rail in Malaysia. In Chapter Four, it has been pointed out that the proportion of modal shift between rail and road transportation was 3:97 in 2004, which then became 2:98 in 2013. This imbalanced development of rail and road transportation may result in ineffectiveness for the dry port's operations, and may even make dry ports unattractive to some customers for utilising their facilities. As indicated by Visser et al. (2009), a limited length of rail track along freight corridors at Southeast Drenthe Dry Port affected the efficiency of dry port operations in the Netherlands. The challenge of limited railway transportation faced by dry ports, compared to the availability of a road transportation system which affects dry port operations will affect dry port operations in Malaysia.

6.4.8.2 Container planning

Almost 73% of interview participants stated that Malaysian dry ports faced challenges in container planning. The first issue related to container planning is the management of empty containers. Worldwide experiences, such as at Cikarang Dry Port in Indonesia,

Valencia Dry Port in Spain and at Coast 2000 in Canada, show that dry ports provide space for managing both laden and empty containers to expedite operations at seaports and as a strategy for future operations (Roso et al. 2009; Frost 2010; CDP 2013). However, in Malaysia PBCT, ICT and NIP currently face space limitations for empty and laden containers, expressed by 64% of the participants interviewed. For example, a participant from the seaport authority stated:

PBCT has insufficient land to expand for its business capacity. This terminal is unable to provide additional space for managing empty containers because the space is provided mainly for laden containers which are more profitable than empty containers (FIP1).

The space constraint of some dry ports in Malaysia may affect their future operations by making them not able to accommodate the increasing volume of containers as a result of the global trend of shipping alliances and increasing container ship size. This could be another reason why Malaysian dry ports are incapable of improving space and contributing trade volume to container seaports.

From the seaport operators' perspective, containers on trains which originated from dry ports and are heading to seaports are not organised according to their vessel schedules. For example, a dry port operator indicated that PBCT faces this issue due to a limitation of facilities, an untrained workforce, and a congestion problem at that dry port (FIP2). A seaport participant (FIP1) commented that they have to re-locate and re-plan unorganised containers at seaports. These relocating and re-planning processes for containers are time consuming and require additional personnel to be involved in these unproductive activities. As a result, it has caused delays to everyone including seaports, shipping lines and rail operators.

About 64% of the participants mentioned that disintegration of container planning on the rail deck affects schedule integrity at seaports. Coupled with the frequent delays in intermodal connectivity (FIP1) and the low frequency of rail trips (FIP7), the issue of container planning on the rail deck (FIP10) will lead to increased empty space in the container vessel and damage the reputation of seaports among its clients.

6.4.8.3 Competition

The cooperation between dry ports and seaports is necessary for increasing the scale of business in a comparatively lucrative segment when adding dry ports to the container freight system (Klink 2000). However, in this research almost 55% of the participants indicated that some dry ports received insubstantial cooperation and recognition from seaports and shipping lines. For example, SIP is one of the dry ports suffering from the lack of recognition from the shipping lines, which has impacted on the volume handled by the dry port (FIP4). One of the reasons for dry ports not being acknowledged is doubt about dry port efficiency arising from knowledge of insufficient railway linkage and their inability to operate with sufficient high-tech facilities and infrastructure (FIP11). This could be another reason why seaports are reluctant to cooperate with dry ports that operate with limited facilities. Cooperation with this kind of dry port may affect the seaport's reputation by causing unreliable services to the clients.

Dry ports are not well recognised to manufacturers either. About 36% of the participants said that most manufacturers and clients have not been aware of the dry ports. As FIP8 commented: *'they (the clients) don't really understand the exact function of dry ports; the limited exposure of dry ports to the clients and manufacturers has resulted in their low utilisation'*. Therefore, it is necessary for dry ports to gain more recognition from seaports, and exposure to the community including both to manufacturers and the general public.

In addition to this recognition issue, the interview outcome showed that competition exists between dry ports and seaports, which affects the extent of cooperation between them. Many shipping lines rely on seaports to provide logistic services to manufacturers who send their containers directly to the seaports, and as a result, they have to compete with dry ports to cater to the local market. This situation has occurred in the southern region of peninsular Malaysia. The intention of seaports to dominate hinterland regional markets has resulted in dry ports becoming a competitor to them (Rodrigue et al. 2010).

Besides seaports, shipping lines are another competitor for dry ports in Malaysia. Almost 55% of the participants said that dry ports faced competition from shipping lines. Some shipping lines are also shareholders for seaports and intend to provide hinterland logistic services to the clients by directing their containers straight to and from seaports without the involvement of dry ports (FIP8). Therefore, they do not favour dry ports located adjacent to seaports because of the competition in door-to-door services (FIP11).

It is noted that a few participants (36%) indicated that hauliers also compete with dry ports. Two interview participants FIP8 & FIP11 stated that SIP has to compete with private hauliers for freight distribution regardless of whether they are short, mid-range or long distances. An official from a dry port (FIP8) mentioned that *'the competition between private hauliers and dry ports occurs because of the differences in freight charges. Private hauliers provide cheaper freight prices compared to that offered by dry ports.'*

Interview participants have indicated that the inefficiency of dry ports is the key factor that has made them unable to cooperate with seaports and shipping lines. As FIP 2 stated *'Dry ports have faced high expectation from seaports to be an all-rounder by providing maximum and recently value adding services with sufficient facilities'. Unfortunately they are unable to meet these expectations* (FIP3). As mentioned earlier, it is mainly because

'limited facilities in dry ports enhance the hesitation of shipping lines to utilise them during container transportation' (FIP11). Besides, the unconvincing volume handled in dry ports reduces the trust of clients to use them(FIP11).

6.4.8.4 Location

Although location was regarded as one of the strengths of Malaysian dry ports by interviewees in section 6.4.7, about 55% of the participants revealed that the location is also a challenge faced by them. They expressed that the location of Malaysian dry ports are not all strategic and that it therefore creates challenges. SIP is a dry port with a location challenge, identified by interviewees. SIP is located in southern Malaysia, and is away from what could be called a strategic location. The location has created difficulties for long shipment(FIP9). In addition, flash flooding in southern Malaysia has serious impacts on SIP's operations(FIP7 & FIP8). Another concern is that the location of SIP is connected with a single mode transportation serving freight to and from it, which is not economic in serving the client and so has recorded low volumes of containers (FIP5).

The location of dry ports at a strategic location especially near manufacturing areas prompts the development of dry ports significantly (Woxenius and Bergqvist 2010). The finding shows that SIP does not meet this criterion. The interviewee FIP9 indicated that the location of SIP is extremely far from the production centre and manufacturing areas in the southern region, so it has been less popular among clients.

6.4.8.5 Community

Malaysian dry ports have generated concerns from the community. About 45% of the interview participants indicated that dry ports generate issues that affect the local

community. The main issues include noise and air pollution generated by freight vehicles, the operations of handling equipment, and traffic congestion in some regional areas.

A total of 45% of participants indicated that the existence of a dry port relies greatly on single mode of transportation, i.e. road which increases pressure especially on a city area. For example, FIP5 commented '*the domination of the road haulages in ICT and NIP creates a nuisance to society by increasing the sound and air pollution*'. Furthermore, FIP9 pointed out that the land infrastructures, especially roads, flyovers, road dividers and traffic lights have become damaged by the pressure of freight vehicles. Long and inconvenient road gradients, detours by hauliers to avoid congestion and toll charges contribute to service inefficiency(FIP9). The overuse of road has deteriorated the road conditions and affected passengers and freight transportation on them.

The noise and vibrations generated by freight vehicles and the operations of handling equipment have contributed to discomfort for the public (Hanaoka & Regmi 2011). Some interview participants addressed this fact by saying that the domination of freight vehicles on roads delay the upgrading of infrastructure in Malaysia. For example, FIP5 commented '*the hauliers at Port Klang utilise the road 24/7. We are unable to repair/upgrade the road even at night*'. The over utilisation of road transportation without frequent inspections affects the condition of roads and simultaneously affects road freight transportation. The overuse of damaged roads affects the container freight transportation to and from Port Klang and the connectivity to all dry ports connected to Port Klang especially NIP and ICT.

About 36% of the participant felt that limited transportation options in dry ports have caused traffic congestion and affected the efficiency of container distribution, especially in Port Klang, Penang Port and PTP. The interviewee FIP5 indicated that Kula Lumpur,

Penang and Johor are congested metropolitan cities. Limited freight transportation options worsen the situation and affect dry port transportation services to their clients.

These outcomes have indicated that challenges faced in Malaysian dry ports are similar to global trends in dry port development. However, the challenges faced by the local community that were noted, are unusual in dry port operations compared to global trends. Sound and air pollution, domination of the road by haulages, infrastructural exhaustion, delay in upgrading infrastructure and a lack of awareness of dry port operations have indicated that Malaysian dry ports need to utilise opportunities in the container seaport system to draw up significant strategies and ensure this intermodal terminal comes to provide a competitive advantage to Malaysian trade.

6.4.9 Influencing factors for dry port operations

During the interviews, participants were asked about their view on influencing factors for Malaysian dry port operations (question C1) and the impact of dry ports on seaport competitiveness (question C2). The results from the interviews, coupled with findings in the literature, have helped the researcher to prepare a survey instrument for data collection in the quantitative phase of this research. This section shows the results relating to these influencing factors for dry port operations, while the next section shows the results of impacts by dry ports on seaport competitiveness.

The participants highlighted five main factors influencing Malaysian dry port operations: features, capacity, hinterland conditions, information systems and government policy (see figure 6.8). First, the service feature is the most important factor influencing Malaysian dry port operations, with all participants agreeing. They also indicated value adding services (100%), customs clearance (91%), storages services (82%) and container maintenance (73%) are key services which should be provided at dry ports. Second, 91%

of the participants indicated that capacity is another factor. Facilities (91%) and space (73%) were identified by the participants as the most important components making up a dry port's capacity.

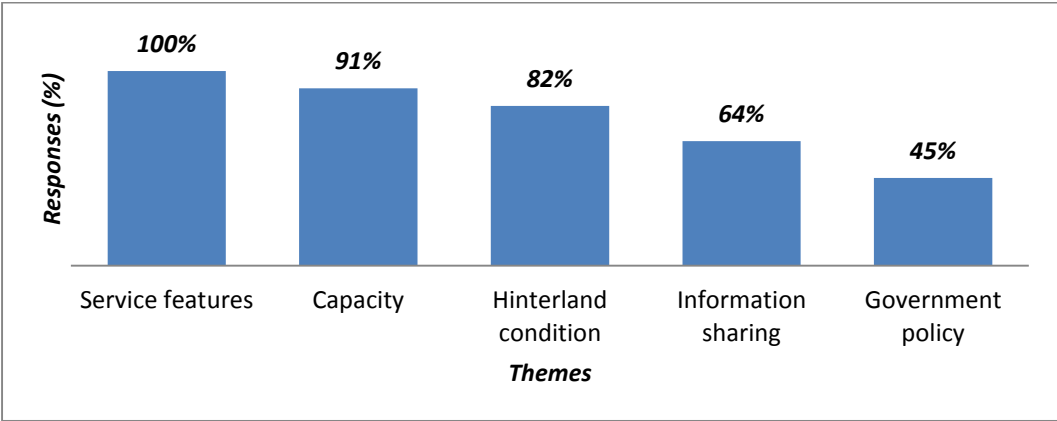


Figure 6.8: Interviewees' views on influencing factors for dry port operations

Third, almost 82% of the participants indicated that hinterland conditions influence dry port operations, consisting of the location of the dry port (82%) and the transport connectivity between seaports and the dry port (73%). Fourth, about 64% of the participants indicated that efficient information sharing is required for dry port operations. They indicated that information sharing need to be utilised for coordination between various clients along the supply chain (64%) and for information collaboration between clients (55%). Finally, the government also influences dry port operations. Participants indicated that cabotage policy (45%) and national seaport policy (27%) have significant impacts on the role of dry ports in the container seaport system.

6.4.10 The impact of dry ports on seaport competitiveness

During the interview sessions, participants indicated that there are four main impacts of dry port operations on container seaport competitiveness, namely seaport-hinterland proximity, seaport performance, seaport capacity and seaport container trade as shown in Figure 6.9.

Firstly, almost 82% of the interview participants stated that dry ports in Malaysia can improve seaport-hinterland proximity through providing seaport-dry port accessibility (82%), enhancing hinterland connectivity (73%), improving multimodalism transportation for container distribution (64%), and developing crossborder connectivity (45%). Secondly, 73% of interview participants indicated that seaport performance may improve as a result of the existence of dry ports in the network. They further stated that the areas that can be improved are shipping schedules, dwelling times at seaports (55%), ship call frequency (55%) and logistic charges (45%). Thirdly, 73% of the participants indicated that dry ports have a significant impact on seaport capacity by improving space availability in seaports and providing additional facilities for effective seaport operations in Malaysia (73%). Finally, 64% of the participants pointed out that the trade volume at seaports may increase by utilising dry ports.

6.5 Development of the online survey instrument

The outcomes in section 6.4.9 and 6.4.10 will be further validated in the quantitative phase through an online survey.

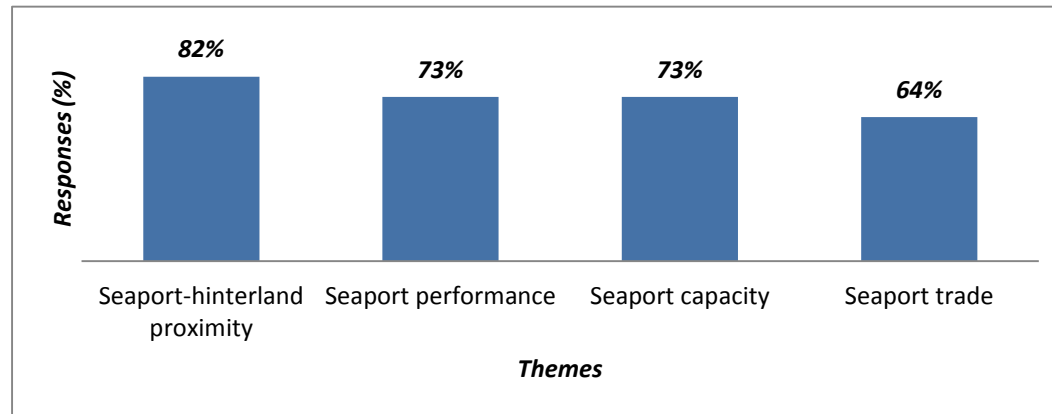


Figure 6.9: Interviewees' views on impact of dry ports on seaport competitiveness

Relevant literature was also used to support the questionnaire development. The quotes, statements and themes from the qualitative phase were used as input for survey instrument development so that an online survey could be conducted.

There were four sections of the questionnaire consisting of Section A (30 questions on the respondent's background), Section B (26 questions on influencing factors of dry port operations), Section C (16 questions on the impact of dry ports on seaport competitiveness), and Section D (5 supporting questions).

Two types of questions were used in the questionnaire which combined multiple questions and matrix questions. The multiple choice questions were selected to collect respondent's demographic information in Section A and to garner their opinion in Section D. This type of matrix question was used for Sections B and C because it provides an opportunity to insert several options/items within a single theme oriented question (Cooper & Schindler 2011). After completing the questionnaire design, the pretesting procedure as explained in section 5.5.2 (Chapter Five) and consultation with the primary supervisor, the online survey was then conducted from the 15th of December 2014.

6.6 Summary

This chapter presented the analysis results of a semi-structured face-to-face interview to answer the first secondary research question. Malaysian dry ports play their role as an extended seaport inland, as regional intermodal nodes and as an interface terminal between seaports and other clients inland. The objectives of dry ports are to enhance trade development, encourage multimodal systems in the nation, improve seaport competitiveness, encourage regional economic development and establish Malaysian seaport policy. Dry ports execute transport, logistic, value adding services and administration functions for their clients. There are three type of strengths discovered from the existing dry ports; the location of dry ports, the involvement of public and private partnerships and transport connectivity.

Dry ports face some significant challenges, especially in having limited transport infrastructure, inefficient container planning, severe competition from seaports and transport operators, less strategic locations and issues related to the community. These challenges affect the effectiveness of dry port functions in the container seaports system.

The participants proposed five influencing factors that affect dry port operations and four impacts of dry ports on seaport competitiveness. Influencing factors of dry port operations are service features, capacity, the condition of the hinterland, information sharing and government policy. On the other hand, the impacts of dry ports on seaport competitiveness are that they improve seaport-hinterland proximity, enhance seaport performance, amplify seaport capacity, and improve seaport container trade. The next chapter will present and discuss the findings of the quantitative phase.

CHAPTER SEVEN

QUANTITATIVE DATA

ANALYSIS AND

DISCUSSION

7.1 Introduction

Chapter Six disclosed the findings of face-to-face interviews with 11 dry port stakeholders. It discussed the roles, functions, objectives, and benefits of Malaysian dry port operations. Outcomes from the qualitative phase were used to develop an online survey instrument to validate influencing factors of Malaysian dry port operations and the impacts of Malaysian dry ports on container seaport competitiveness. This chapter employs the exploratory factor analysis (EFA) method to analyse the data collected, and it discusses the results for answers to SRQ2 as stated below.

SRQ2: What are the influencing factors of Malaysian dry port operations and their impacts on the competitiveness of Malaysian container seaports.

This chapter starts by giving the response rate of online surveys and an analysis of the demographic information of the 120 respondents, followed by a presentation of descriptive statistics. It then explains the procedure of performing EFA, presents the analysis results, and discusses the findings.

7.2 Online survey response rate

Questionnaires were distributed to 260 Malaysian dry port stakeholders consisting of freight forwarders, hauliers, seaports, shippers, shipping lines and railway operators. A total of 120 responses were received, achieving a response rate of 46.1 %. The response rate gives reasonable weight and credibility to this research because it has exceeded the minimum response rate of 33 % required for an online survey (Nulty 2008).

Table 7.1 shows the sample size and response rate of respective groups surveyed. A total of 35 (29.2%) responses were received from freight forwarders, 42 (35%) from hauliers and 13 (10.8%) from shipping lines. Moreover, 14 (11.7%) responses were received from

shippers, 4 (3.3%) from rail operators and 12 (10%) from seaports. Regarding the response rate, hauliers and shippers had the highest response rate of 70%, while the freight forwarder group had the lowest of 29.4%.

Table 7.1: Response rates for the online-survey

Stratum	Population	Sample size	Response received	Response rate
<i>Freight forwarders</i>	119	119	35 (29.2%)	29.4%
<i>Hauliers</i>	60	60	42 (35%)	70 %
<i>Shipping lines</i>	116	30	13 (10.8%)	43.3%
<i>Shippers</i>	20	20	14 (11.7%)	70%
<i>Rail operators</i>	10	10	4 (3.3%)	40%
<i>Seaports</i>	21	21	12 (10%)	57.1%
Total	346	260	120 (100%)	46.1%

7.3 Demography of respondents

The demographic information from the survey was used to review the characteristics of respondents. Table 7.2 presents a summary of the respondents' work positions and the years of experience that they had in their respective fields. Of the 120 respondents, 51 (42.5%) were executives and coordinators. Fifty-two (43.3%) were middle level managers including general managers, regional managers and division managers, and 17 (14.2%) were at the top level of management positions as directors, chief executive officers (CEOs) and advisors. In sum, 69 (57.5%) respondents were in middle and top management positions. Because top and middle level managers possess a decisional role that ensures that their organisation utilises development strategies and resources (DuBrin 2003), the responses from these groups are expected to produce significant findings for this research.

In respect to the respondents' work experience, almost half (50%) of them possessed less than 10 years of experience in their respective fields, while another half had more than 11

years of experience in the maritime business sector. In total, about 87% of the respondents had at least 6 years experience. Respondents with more working experience are expected to provide more precise information than those with less experience, which ensures the quality of the research (Eshuis et al. 2013).

Table 7.2: Summary of respondent demography

No.	Position	Response	Percentage (%)
1.	Executives	38	31.7
2.	Coordinators	13	10.8
3.	Middle level Managers	52	43.3
4.	Directors	8	6.7
5.	CEOs	5	4.2
6.	Advisors	4	3.3
No.	Experience	Response	Percentage (%)
1.	0-5 years	16	13
2.	6-10 years	44	37
3.	11-15 years	35	29
4.	Over than 16 years	25	21

7.4 Descriptive statistics

This section presents outcomes for the descriptive statistics of responses to the questions in Sections B and C of the questionnaire. The constructs for the two sections concern influencing factors of dry port operations and the impacts of dry ports on container seaport competitiveness. These two constructs were empirically tested as latent variables for the dependent variables of dry port operations (Section B), and seaport competitiveness (Section C). Items for each latent variable were known as independent variables (Pallant 2001). In order to ensure the parametric nature of the data, Likert scale items were used to gather data, as they allow the use of parametric statistical tools for data analysis (Carifo & Perla 2007).

Descriptive statistics were computed for each item to identify the frequency of responses, mean, 5% trimmed mean, standard deviation (SD), skewness and kurtosis. The mean and

5% trimmed mean for each item were very similar, which shows no presence of extreme scores (Rovai et al. 2013). The standard deviation for all items in section B and C were in the range of 0.49 and 1.11. Skewness and kurtosis in most cases were within the optimal range of +/- 1.00. These conditions illustrated the parametric nature of the data (Rovai et al 2013). E.1 and E.2 in Appendix E show the details of the descriptive statistics for Sections B and C.

7.4.1 Reliability of the constructs

Cronbach's Alpha reliability analysis was conducted to measure the internal consistency of the two constructs (see table 7.3). The value of internal reliability with Cronbach's Alpha of 0.7 or more indicated a high level of accuracy in the measurement procedure (Rudner 2001). In this research, Cronbach's Alpha of reliability analysis for both constructs was above 0.7, indicating the internal consistency of the scale. Differences between Cronbach's Alpha and Cronbach's Alpha based on standardised items for each scale were very small, showing similar item means and standard deviation for each item in the construct (Rovai et al. 2013).

Table 7.3: Summary of Cronbach's Alpha value for the 2 constructs

Scale/construct	Cronbach's Alpha	Cronbach's Alpha based on standardised items	No. of Items
Section B: Influencing factors of dry port operations	0.934	0.930	26
Section C: Impacts of dry ports on seaport competitiveness	0.871	0.880	16

7.4.2 Missing data analysis

Data with more than 15% missing values should be deleted (Hair et al. 2010). In this research, no such case was detected and the maximum value of missing data 6.4% was

detected in section B16. Hence, to replace the missing value, the ‘excluded case pairwise’ option of SPSS was applied because it is designed for a specific analysis and it reduces the impact of missing data (Pallant 2011). This option permits exclusion of respondents if there was missing data detected in the data sheet while conducting the specific analysis.

No missing value was identified in section A. In section B, 11 missing values were found, with 2 (2.5%) from question B5, 1 (1.2%) from B7, 5 (6.4%) from B16, and 1 (1.2%) each from B20, B22 and B23 respectively. Section C recorded 8 missing values with 1 (1.2%) detected from section C11, 4 (5.1%) from C13 and 3(3.8%) from C16. Finally, in section D, there were 6 missing values recorded which were evenly distributed in questions D1.1 (2.5%), D1.2 (2.5%) and D2.2 (2.5%). Table 7.4 summarises the missing value detected.

Table 7.4: Missing data analysis

Section	Missing data*					
A. Profile	No missing values					
B. Influencing factors of dry port operations	B5	B7	B16	B20	B22	B23
	2(2.5%)	1(1.2%)	5(6.4%)	1(1.2%)	1(1.2%)	1(1.2%)
C. Impact of dry ports on seaport competitiveness	C11		C13		C16	
	1(1.2%)		4(5.1%)		3(3.8%)	
D. Others	D1.1		D1.2		D2.2	
	2 (2.5%)		2 (2.5%)		2 (2.5%)	

*Missing data includes the ‘not applicable’ option in the questionnaire as well as no response being found in the ‘not applicable’ option

7.4.3 Container seaports used by respondents

Question A4 asked the respondents about how frequently they used the six Malaysian container seaports in their daily operations. The result indicated that Port Klang was the most frequently used by respondents, with a mean of 4.12 (see figure 7.1). Penang Port is the second most frequently used seaport with a mean of 3.86. Although PTP is the second most important container seaport after Port Klang in Malaysia, it was the third seaport

frequently used by respondents, with a mean of 3.83. Johor Port and Kuantan Port were ranked 4th and 5th with a mean value of 3.01 and 2.12 respectively (see E.3 in Appendix E).

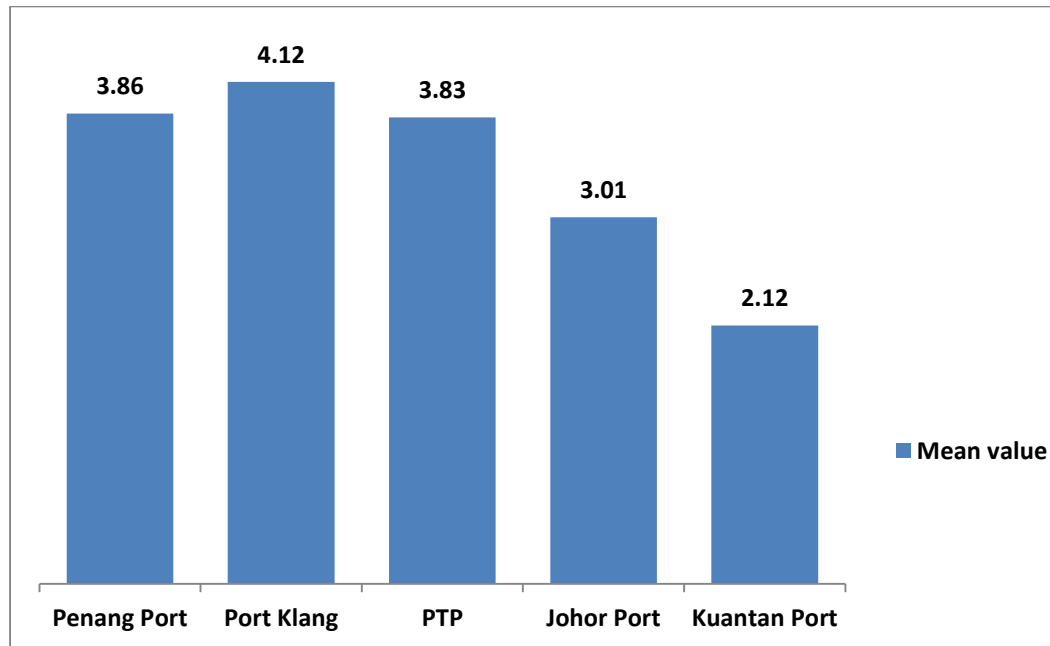


Figure 7.1 Container seaports frequently used by respondents

7.4.4 Dry ports used by respondents

Question A5 asked the respondents how frequently they used the existing dry ports in their daily operations. As shown in figure 7.2, among four dry ports, ICT was the most frequently used by the respondents, with a mean value of 3.77. This could be because the dry port connects to all major seaports, especially to Port Klang, PTP and Penang Port via road and rail. NIP was the second most frequently used dry port with a mean of 3.63, followed by PBCT (mean value 3.32) and SIP (mean value 3.04). NIP is surrounded by many manufacturers compared to other dry ports, and PBCT is located close to the border and attracts trade from Southern Thailand. The lack of facilities, and being so far away from manufacturing industrial zones have made SIP the least used dry port.

7.4.5 Influencing factors of dry port operations

Section B presented a question with 26 items to explore influential factors for Malaysian dry port operation within the container seaport system.

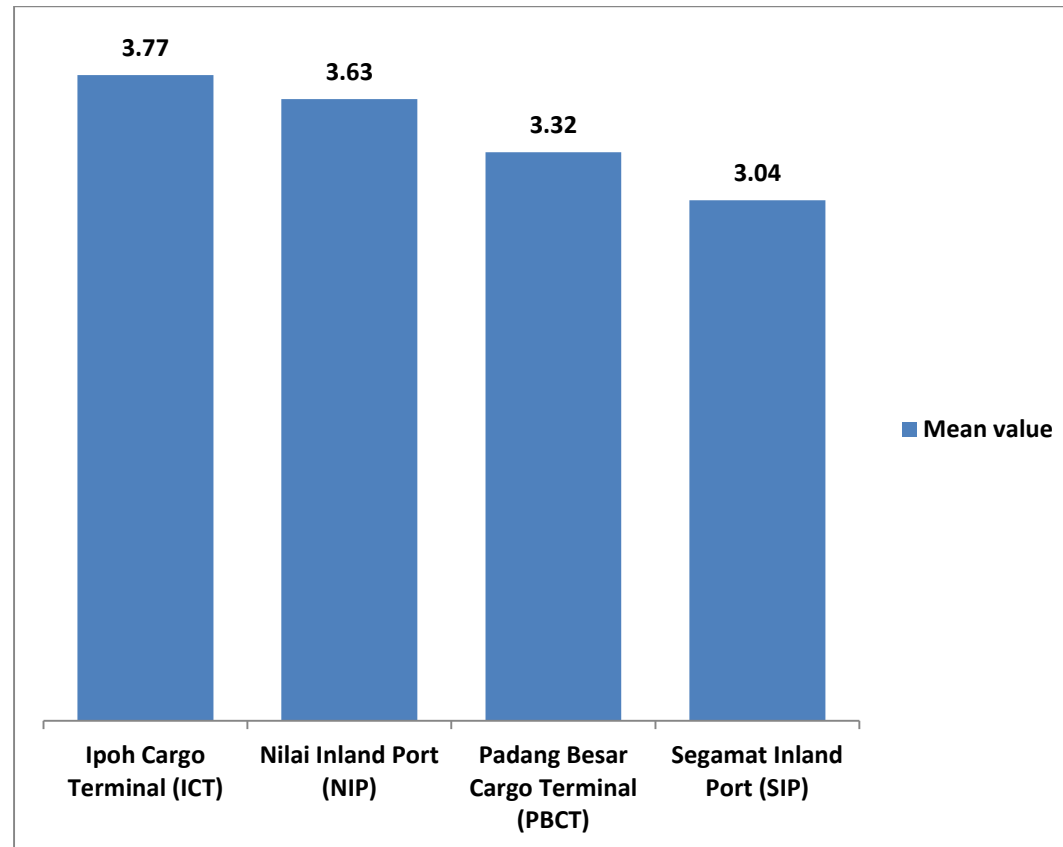


Figure 7.2 Important dry ports among the respondents

Table 7.5 depicts the descriptive statistics of this construct. Item B9 customs, immigration and police inspection services had the highest mean of 4.81 whereas items B21 public ownership and B22 private ownership had the lowest mean of 3.83 and 3.77 respectively. Overall, the result showed that 24 out of 26 items are of mean values over 4.0, indicating that they are very important factors for Malaysian dry port operations in the container seaport system.

Table 7.5: Influencing factors of Malaysian dry port operations

Question/Item	Mean	Std. Deviation
Question: How important are the following for influencing Malaysian dry port operations?		
B1. Located near to a border, seaport or industrial zone	4.58	0.495
B2. Road connectivity	4.52	0.635
B3. Rail connectivity	4.42	0.669
B4. Cooperation with seaports	4.17	0.833
B5. Container storage services	4.34	0.680
B6. Value adding services	4.42	0.706
B7. Rail-truck transfer services	4.39	0.759
B8. Container maintenance services	4.40	0.691
B9. Customs, immigration and police inspection services	4.81	0.395
B10. Sufficient equipment	4.32	0.661
B11. Modern and sophisticated equipment	4.27	0.742
B12. Well maintained equipment	4.35	0.718
B13. Adequate highways and wide roads	4.41	0.716
B14. Adequate railway tracks	4.32	0.710
B15. Sufficient space for containers	4.27	0.673
B16. Space utilisation via collaboration	4.23	0.730
B17. Coordination for risk sharing	4.18	0.904
B18. Coordination for facility utilisation	4.23	0.864
B19. Providing information for accurate decision making	4.07	0.936
B20. Information of container flow forecasting	4.11	0.877
B21. Public ownership	3.83	1.103
B22. Private ownership	3.77	1.121
B23. Public-private investment	4.21	0.849
B24. Cabotage policy	4.26	0.835
B25. Multimodal transport infrastructure development policy	4.34	0.783
B26. Seaport policy (land side transportation)	4.29	0.814

7.4.6 The impact of dry port operations on seaport competitiveness

Section C presented a question with 16 items in it to explore the impacts of dry port operation in the container seaport system (see Table 7.6). Item C6 was about whether they expand seaport hinterland transport networks and had the highest mean of 4.48, whereas item C13 was about whether they increase the volume of containers for inland transshipment, and had the lowest mean of 4.16. All 16 items were of a mean value of more

than 4.0, indicating that from the perspective of dry port stakeholders in Malaysia, the operation of dry ports does have significant impacts on seaport competitiveness.

Table 7.6: Impacts of dry ports on seaport competitiveness

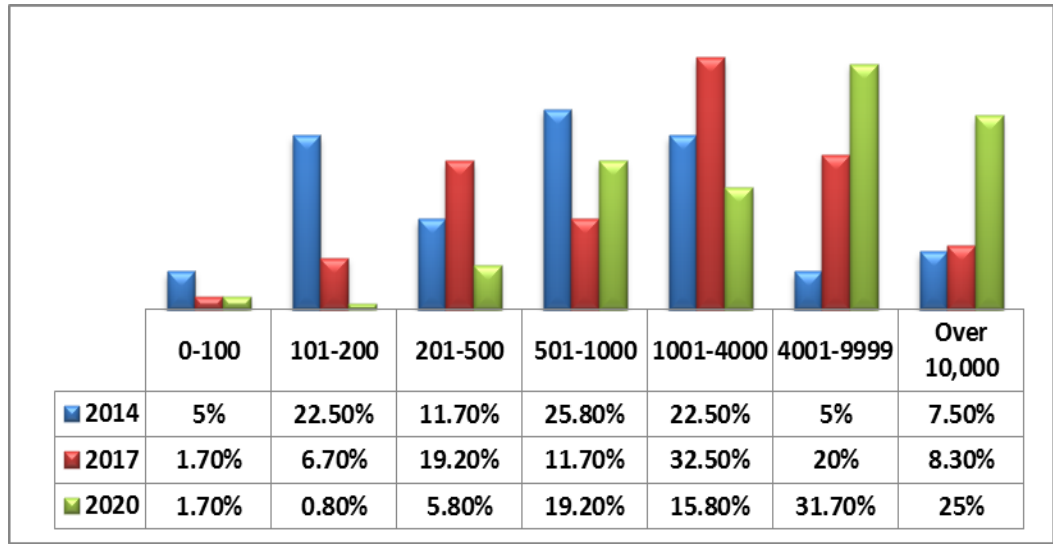
Question/Item	Mean	Std. Deviation
Question: To what extent do you agree that the following impacts on container seaport competitiveness are caused by dry ports?		
C1. Increase ship call frequency	4.42	0.630
C2. Increase seaport reliability (stability and quality of service)	4.32	0.712
C3. Increase seaport efficiency	4.24	0.756
C4. Reduce inland distribution costs	4.37	0.697
C5. Increase berth productivity	4.27	0.658
C6. Expand seaport hinterland transport networks	4.48	0.518
C7. Improve seaport hinterland access	4.23	1.075
C8. Increase accessibility to and from seaports	4.44	0.531
C9. Improve seaport hinterland connectivity	4.43	0.530
C10. Provide additional space for seaports	4.40	0.571
C11. Provide additional facilities for seaports	4.41	0.587
C12. Increase continuity of containers to seaports	4.28	0.688
C13. Increase volume of containers for inland transshipment	4.16	0.789
C14. Increase supplementary services for seaports	4.28	0.663
C15. Shift value adding services of seaports to inland	4.23	0.719
C16. Support seaport flexibility	4.26	0.667

7.4.7 Expected throughput

Question D1 asked the respondents about container volume to be generated in their organisations during 2014-2020 (see table 7.7). The result showed that between 2014 and 2020, respondents estimated that their container volume would be between 0-1000 TEUs, with 65% of them estimating that for 2014, and 39.3% for 2017, and 27.5% for 2020. On the other hand, more respondents estimated that container volume would increase to over 1000 TEUs during that time, with 35% of respondents estimating it for 2014, 60.7% for

2017 and 72.5% for 2020 (see E.4 in Appendix E). This trend implies that there is strong possibility of increase in demand at dry ports.

Table 7.7: Estimated TEUs among dry port users 2014-2020



7.4.8 The importance of transportation modes for container transportation

In general, the inland transportation component of Malaysia is dominated by road and rail transportation. Question D2 elicited respondents’ perspectives on the importance of road and rail transportation for inland container freight distribution. The results showed that both road and rail transportation were equally important for inland container transportation, with the mean value of 4.6 being for road transportation, and 4.24 for rail (see E.5 in Appendix E).

7.5Exploratory factor analysis on Malaysian dry ports

Exploratory factor analysis (EFA) explores the factor structure of a set of observed variables without imposing a predefined structure on the outcome (Suhr 2006). The variables that determine the influencing factors of dry port operations and the impact of dry ports on seaport competitiveness have been structured based on the outcomes of a

literature review and the results of the qualitative phase. The EFA was based on the items of the online questionnaire for Section B and C, in order to achieve a significant factor structure through a clear pattern matrix.

7.5.1 Suitability of data for EFA

Before conducting an EFA, data suitability should be checked to produce valid and reliable results (Pallant 2011). Several suggestions have been made regarding this:

- 1) Various opinions exist on the adequacy of sample size discovered for factor analysis. Hair et al. (2010) suggested that the sample size for factor analysis needs to be more than 100. As the sample size for this research is 120, it implies the suitability of factor analysis for it.
- 2) Bartlett's Test of Sphericity should be significant at $p < 0.05$, which indicates adequate correlations among variables to support the normal basis for factor analysis (Pallant 2011).
- 3) The Kaiser-Mayer-Olkin (KMO) index should be at least 0.60 which ensures the suitability of data for extraction of factors (Rovai et al. 2013).
- 4) Parametric data are required for factor analysis (Pallant 2011). Normality in factor analysis can be measured by the skewness and kurtosis value which should be between ± 1.00 (Minckler 2011).
- 5) Uniformly high communalities value without cross loading shows strong data for factor analysis (Costello 2005).
- 6) A correlation coefficient on a maximum value of ± 0.5 is practically significant, with ± 0.4 as important and ± 0.3 considered a minimum value (Williams et al. 2010).

Based on the aforementioned assumptions (2)-(6), the suitability of data for EFA in this research are addressed, along an explanation of the results in the following sections.

The application of EFA followed by multiple regression requires a bias analysis through Common Method Bias (CMB). Therefore, the common method bias has been conducted through Harman single factor analysis uses EFA where all 42 variables loaded into a single factor. In any analysis, the newly introduced common latent factor explains more than 50 percent of the variance indicates the presence of bias in the result (Eichhorn 2014). However, in this research, the Common Method Variance (CMV) value is 27.015 percent and clearly indicates the absence of bias in the findings (see table 7.8).

Table 7.8: Result of Common Method Bias

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.048	27.015	27.015	14.048	27.015*	27.015
2	4.470	8.596	35.611			
3	3.465	6.663	42.274			
4...	2.776	5.338	47.612			

* CMB value: 27.015 percent

7.5.2 The factor extraction method

The factor extraction method provides a solution with several variables explaining the maximum variance of the data (Pallant 2011). It is important to employ the factor extraction method to provide a clear factor structure (Rovai 2013). In this research, the extraction method of principle component analysis (PCA) has been employed as it provides a clear factor structure. PCA reduces a large number of variables to a smaller set of components that account for a large amount of observed variance. Further, this

extraction method fixes the number of factors for a satisfactory solution, and is normally used for EFA (Williams et al. 2010).

7.5.3 Criteria for extraction and the rotation method

Factor extraction is to reduce a large number of factors into a suitable number of factors (Pallant 2011). There are several criteria proposed by Williams et al. (2010) to fix the number of factors, including Kaiser's criteria (eigenvalue > 1) and the number of factors above the point of break in a screen plot. In this research, all the aforementioned criteria have been examined for all factors to extract the appropriate number of factors. It aims to retain most of the conceptual sense which explains more than 60% of the total variance (Hair et al. 2010).

A rotation method aims to assist in obtaining a new set of factor loadings from a given set. There are two common rotation methods, namely Orthogonal and Oblique (Field 2009). Although both types of rotation explain the same amount of variance, in this research, Orthogonal varimax rotation has been applied because it determines the adequacy of rotation and assumes that the generated factors are independent (Tabachnick & Fidell 2000). In addition, Orthogonal rotation is preferred when conducting an EFA (Williams et al. 2010).

The varimax rotation aims to maximise the sum of variances of squared loadings in the columns of the factor matrix to produce loading in each column from a high value to zero value, which facilitates the interpretation (Kline 1994). This rotation locates clusters more successfully compared to other types of rotation (Nunnally & Bernstein 1994). In this research, clustering the variables is an important task because there is no previous research on dry ports in the container seaport system of Malaysia; therefore, it requires a precise clustering procedure to achieve a significant outcome.

7.5.4 Interpretation and labelling

Interpretation is a crucial section of EFA and requires subjective, theoretical and pragmatic procedures to develop meaningful latent factors, while a labelling procedure should reflect the conceptual and theoretical intent (Tabachnick & Fidell 2000). Inputs to develop all items for questions in Section B and C were derived from a reliable data collection instrument developed from an extensive literature review and face-to-face interviews. These procedures were utilised to generate significant insights for latent interpretation and labelling.

7.6 Influencing factors of dry port operations

The suitability of the data in this research was examined before performing an EFA. The values of correlation coefficient among the variables in section B were at a moderate level (+/- 0.3). All the items met the assumptions and were strong enough for factor analysis, as it produced moderate to high extraction scores (between 0.6-0.8) for communalities (see E.6 in Appendix E). Moreover, the Kaiser-Meyer-Olkin index 0.855 above the recommended value 0.6 supported the sampling adequacy in this research. In addition, Bartlett's Test of Sphericity was statistically significant ($p < 0.05$), which showed that variables were correlated for a reasonable factor analysis (see Table 7.9).

Table 7.9: KMO and Bartlett's test (initial run)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.855
Bartlett's Test of Sphericity	Approx. Chi-Square	2398.149
	Df	325
	Sig.	.000

The outcome from the initial run confirmed that the variables for Section B are fit for a factor analysis procedure. Next, the outcomes of the extractions for Section B are

explained. Although there is no firm standard to determine the optimum loading values, Comrey and Lee (1992) offer a guideline for interpreting the loading as follows: 0.71= (excellent), 0.63 = (very good), 0.55= (good), 0.45= (fair), and 0.32 = (poor). They indicated that variables with the loadings value of more than 0.5 assist the researcher in drawing a definite conclusion about the component.

Hair et al. (2010) have developed a loading size based on sample size. The sample size in the research was 120 and so the appropriate loading size will be 0.5 and above. Therefore, in this research the variables with a loading value of more than 0.5 will be retained to make certain assumptions of the factors influencing dry port operations and the impact of dry ports on seaport competitiveness.

There were 26 variables which were identified during the literature review procedure and the face-to-face interview procedure. During rotation, seven components were identified and variables with a loading value of more than 0.5 were retained for discussion (see table 7.10). Seven components demonstrated a cumulative percentage variance of 76.62% and had an eigenvalue > 1. During the rotation procedure, all variables were reduced to seven distinct components for further discussion.

Table 7.11 shows the loadings and items in each component. All rotated components had average loading values of between 0.5-0.9. The first component consisted of seven factors whose loadings were very good and excellent (at between 0.65-0.78). The second component had five factors with one good loading (of 0.56) and four excellent loadings (between 0.77-0.87).

Table 7.10: Total variance explained for responses in Section B of the survey

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	8.877	36.989	36.989
2	2.687	11.198	48.187
3	2.059	8.578	56.764
4	1.634	6.807	63.571
5	1.081	4.505	68.076
6	1.048	4.366	72.442
7	1.005	4.187	76.629
8	.899	3.746	80.375
9	.715	2.979	83.355
10	.633	2.639	85.994
11	.471	1.962	87.955
12	.432	1.802	89.757
13	.401	1.669	91.426
14	.367	1.531	92.957
15	.305	1.270	94.228
16	.267	1.112	95.340
17	.233	.973	96.312
18	.190	.793	97.105
19	.165	.689	97.794
20	.135	.560	98.355
21	.116	.484	98.839
22	.106	.442	99.281
23	.100	.418	99.699
24	.072	.301	100.000
Extraction Method: Principal Component Analysis			

The loadings of the three factors in the fifth component were of one good (0.54) and of two excellent (between 0.77-0.79). Components six and seven had one factor respectively with excellent loadings (of 0.8 and above). The third component consisted of four factors with excellent loadings of between 0.71-0.86. The fourth component had three factors with excellent loadings between 0.73-0.92.

Table 7.11: Rotated component matrix (showing all values)

	Component						
	1	2	3	4	5	6	7
B12. Well maintained equipment	.784	.264	.119	.036	.272	.065	.006
B11. Modern and sophisticated equipment	.775	.215	.236	.165	.152	-.093	-.035
B14. Adequate railway tracks	.755	.215	.215	.024	.082	.243	.215
B13. Adequate highways and wide roads	.741	.225	.124	-.029	.065	.262	.283
B10. Sufficient equipment	.673	.124	.218	.209	.109	-.352	-.272
B15. Sufficient space for containers	.671	.389	.110	.202	.092	-.001	-.034
B16. Space utilisation via collaboration	.650	.359	.195	.160	.080	.031	-.078
B18. Coordination for facility utilisation	.287	.878	.151	.095	.020	-.042	.033
B19. Providing information for accurate decision making	.236	.868	.152	.098	.118	-.137	-.091
B20. Information of container flow forecasting	.314	.778	.207	.205	.007	-.090	-.134
B17. Coordination for risk sharing	.346	.773	.130	.118	-.101	.092	.016
B23. Public-private investment	.236	.563	-.014	.538	-.055	.224	.071
B6. Value adding services	.147	.160	.868	-.013	.117	.019	-.041
B7. Rail-truck transfer services	.194	.064	.824	.009	.199	.049	.033
B8. Container maintenance services	.269	.066	.763	.253	.133	.017	.161
B5. Container storage services	.148	.283	.719	.170	.066	.040	-.145
B25. Multimodal transport infrastructure development policy	.059	.061	.120	.927	.038	-.056	-.056
B26. Seaport policy (land side transportation)	.083	.091	.088	.904	.084	-.069	.013
B24. Cabotage policy	.201	.358	.111	.732	-.043	.195	.097
B3. Rail connectivity	.117	.002	.193	-.007	.799	.163	.210
B2. Road connectivity	.232	-.117	.209	-.028	.770	.145	-.035
B4. Cooperation with seaports	.203	.339	.099	.307	.543	-.221	-.020
B1. Located near to a border, seaport or industrial zone	.117	-.068	.096	.051	.189	.805	-.129
B9. Customs immigration and police inspections services	.057	-.089	-.007	.043	.121	-.113	.881

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Based on the outcome of the literature review and the face-to face interviews, each component was labelled with meaningful terms. The seven components were labelled subsequently as capacity, information sharing, service features, government policy, hinterland condition, location and administration.

7.6.1 The validity and reliability of EFA results

The Cronbach's Alpha coefficient, a reliability test as recommended by Garver et al. (2008) indicated that the value for rotated variables was 0.909 (capacity), 0.917, (information sharing), 0.869 (service features), 0.875 (government policy) and 0.726 (hinterland condition) which indicated a high reliability of the results (see Table 7.12). The results indicated a relatively high level of accuracy in the measurement procedure (Rudner 2001).

However, there were two factors with only a single item, and so were unable to be measured for Cronbach alpha value. As indicated by Christophersen and Konradt (2011), communality may be used as a conservative estimate of an item's reliability. Based on the commonality value, the estimated reliability of the two factors with a single item was 0.773 (location) and 0.839 (administration) respectively. The EFA produced a seven-factor model with 26 items that influence Malaysian dry port operations, whereby all the factor loadings met the convergent validity of 0.5 and above, and all the eigenvalues for the seven-factor model were greater than 1.

7.6.2 Discussion of results

The outcomes from the EFA consisted of seven main factors that influence dry port operations, namely capacity, information sharing, service features, government policy, hinterland conditions, location and administration. Those factors are discussed in the following sections.

Table 7.12 Reliability test for EFA results (Section B)

Outcome from EFA	Influencing factors of dry port operations	No. of items and Cronbach Alpha
Capacity	B12. Well maintained equipment B11. Modern and sophisticated equipment B14. Adequate railway tracks B13. Adequate highways and wide roads B10. Sufficient equipment B15. Sufficient space for containers B16. Space utilisation via collaboration	7 (0.909)
Information sharing	B18. Coordination for facility utilisation B19. Providing information for accurate decision making B20. Information of container flow forecasting B17. Coordination for risk sharing B23. Public-private investment	5 (0.917)
Service features	B6. Value adding services B7. Rail-truck transfer services B8. Container maintenance services B5. Container storage services	4 (0.869)
Government policy	B25. Multimodal transport infrastructure development policy B26. Seaport policy (land side transportation) B24. Cabotage policy	3 (0.875)
Hinterland condition	B3. Rail connectivity B2. Road connectivity B4. Cooperation with seaports	3 (0.726)
Location	B1. Located near to a border, seaport or industrial zone	1 (0.773)
Administration	B9. Customs immigration and police inspections services	1 (0.839)

7.6.2.1 Capacity

Capacity consisted of items B12 (well-maintained equipment, 0.784), B11 (modern and sophisticated equipment, 0.775), B14 (adequate railway tracks, 0.755), B13 (adequate highways and wide roads, 0.741), B10 (sufficient equipment, 0.673), B15 (sufficient space for containers, 0.671) and B16 (space utilisation via collaboration, 0.650). In terms of the findings, there were three main capacity issues of dry ports i.e. equipment, multimodal

transport infrastructure and space being considered by respondents to influence the operation of Malaysia dry ports.

During the interview session, a participant (FIP2) indicated that the majority of Malaysian dry ports operated with outdated container handling equipment. The current equipment is less efficient and unable to be utilised for rapid operations and to cater for the increasing volume of containers in the future. In addition, according to the information provided by the interview, each Malaysian dry port only operates with 2 to 4 stackers and 4 to 6 forklifts on average. This shows that Malaysian dry ports lack sufficient equipment, and do not meet minimum handling requirements based on guiding principles for dry port operations set by UNESCAP (2010), which stipulate basic facilities as tractor-trailers, lift trucks, rubber-tired gantries and rail-mounted gantries required for dry port operations.

The outdated and not well maintained equipment may result in container damage and accidents, and the lack of tractor-trailers, rubber-tired gantries and rail-mounted gantries may slow down the dry port's productivity. Consequently the attractiveness of the dry port may be reduced. Therefore, to improve the operational efficiency of dry ports, modernised facilities should be invested in and maintained.

As indicated by the majority of interviewees (91%), operational infrastructure which includes equipment is the most important requirement for Malaysian dry port operations. Findings from the qualitative and quantitative phase of this research showed that operational infrastructure was the main pre-requisite for improving performance of dry ports in Malaysia.

Railway infrastructure and its networks also impact dry port operations. Interview results in Chapter Six indicated that limited double track railways and their network was one of

the challenges faced by Malaysian dry ports. The consequence of this challenge has impeded dry ports from freely performing their roles as interface terminals inland and establishing multimodalism for container freight transportation, (according to interview findings FIP1, FIP3, FIP6 & FIP7). Limited railway tracks impact the development of rail freight. In Malaysia, rail tracks are significantly concentrated between states on the west coast compared to those on the east coast. Adequate rail tracks on the east coast and sufficient intra-state linkages would thus be an effective approach for dry ports so that they can perform their role as an extended seaport inland, attract new customers, and enhance their connectivity to the hinterlands. Priority needs to be given to both modes to balance an even development of multimodal transportation and to reduce the pressure on road freight.

Another challenge related to road transport is the coverage of highways and road width. Currently, only 10% of Malaysian roads are classified as highways (Chuen et al. 2014), hence a limitation of accessing wide roads diverts users to re-route, and to utilise state roads which are smaller and narrower. For example, in Port Klang the existing narrow width of road lanes is unstable for catering to freight transportation and creates significant overloading pressure and defects on the road conditions. Imperfections of the road conditions further deteriorates the effectiveness of hinterland connectivity between dry ports and seaports in Malaysia.

According to interview results, one of the challenges that Malaysian dry ports face is over utilised road transport. Almost 80% of the freight task in Malaysia is undertaken by road transport (Masriq 2012). All dry ports in Malaysia mainly use roads for distributing containers between the inland and the seaports. For example, NIP manages the majority of containers to and from major seaports in Malaysia with only road transportation. Without another mode of transport connecting NIP to Port Klang and PTP, the over-utilisation of

the road infrastructure has greatly affected the condition of the roads. The exhausted road infrastructure creates congestion by limiting freight truck accessibility which results in delays to shipping schedules to seaports and affects shipper costs and times.

Currently, as indicated in Chapter Six, almost 64% of the interview participants indicated that dry ports such as PBCT, ICT and NIP have restrictions on land space for empty and laden container storage, while SIP remains underutilised. Therefore, space utilisation through collaboration is important for assisting dry port operations. Collaboration via location pooling with other dry ports or container depots in the region could provide a bright opportunity for PBCT, NIP and ICT to increase their capacity and accommodate laden and empty containers simultaneously. According to one participant (FIP8), space utilisation by PBCT and ICT from location pooling with other dry ports and inland terminals such as Bukit Kayu Hitam and Prai inland depots, generates a healthy network between them, reduces competition and enhances the performance of the dry ports.

7.6.2.2 Information sharing

Factors concerning information sharing are in items B18 (coordination for facility utilisation, 0.878), B19 (providing information for accurate decision making, 0.868), B20 (information of container flow forecasting, 0.778), B17 (coordination for risk sharing, 0.773), and B23 (public-private investment, 0.563).

In Malaysia, information sharing has been significantly identified as a key factor influencing dry port operations. The ability of dry ports to provide accurate information to coordinate facility utilisation and container flow forecasting influences their performance in assisting seaport operations and reduces operational risks. Some dry ports have had issues of low utilisation of their assets, leading to inefficient performance. For example,

SIP has been inefficient because of the low utilisation of its yard capacity. This is evidenced by its limited contribution of containers to Port Klang and PTP, despite it being the largest dry port in Malaysia.

Improving PBCT, NIP and ICT's ability to forecast its throughput via coordination between seaport operators would increase its utilisation in the container seaport system and help plan appropriate strategies for accommodating accelerated container volumes in the future. Providing container flow information forecasting at SIP would assist this dry port to plan its capacity utilisation. Although SIP is the largest dry port in Malaysia, the volume handled by this dry port is the least among the others. On the other hand, NIP is the smallest dry port and has the highest volume recorded of containers handled. In this case, strategies for facility utilisation and forecasting are required to minimise operational risks.

Coordination of container seaport systems involves a variety of players including seaport authorities, container shipping lines, freight forwarders, seaport and inland terminal operators and intermodal transport operators. This coordination initiates equal risk sharing among them and prevents significant impacts falling on a single player. For example, delays and unorganised containers from PBCT provide significant impacts on Penang Port's competitiveness. Hence, information sharing by coordination is required to minimise the risk of delays.

Coordination allows interdependence between organisations because each organisation is dependent on the performance of the other organisations in the chain (Horst & Langen 2008). Therefore, information sharing can help with accurate decision making by each player in the container transportation chain to facilitate the flow of goods and minimise operational deficiency. For example, insufficient hauliers for short distant delivery at ICT caused inefficiency in the supply chain. Hence, when the ICT operator circulated the

information about the delay it greatly assisted the relevant players in the chain including the seaport authorities, container shipping lines, freight forwarders, seaport and inland terminal operators and intermodal transport operators in making appropriate strategies for mitigating the risks of delay.

Encouraging PPP as an investment policy is important for dry port development in Malaysia. Malaysia started port privatisation via Port Klang in 1986, which was the first public entity being privatised. Since then, all seaports have an equal proportion of private and government influence in their management. Following this policy, all four dry ports in Malaysia have been developed using a PPP approach and are operated as well as governed by the private and public sectors. During the interview session, more than half of the participants (55%) indicated that the PPP is one of the main strengths of Malaysian dry ports. Therefore, this strength needs to be utilised by involving the Malaysian government in developing freight corridors and transport infrastructure, and the private sector in investing in operational infrastructure, logistic services and human capital development to enhance all dry port operations.

Funding allocation by the government amounting to USD 5, 245 million for transportation, trade, infrastructure, and industrial facilities (Humphries 2004) created a new strategy to encourage the involvement of the private sector in dry port operations and to invest in rail link development, dry port infrastructure development and initiating new industrial areas close to dry ports. Outcomes from respondents showed that the PPP approach is an important determinant in information sharing as well. This may be because the involvement of the public sector in establishing firm regulatory procedures and for the private sectors in investing simultaneously in dry ports, encourages information sharing among players.

7.6.2.3 Service features

There were four items generated for service features including B6 (value adding services, 0.868), B7 (rail-truck transfer services, 0.824), B8 (container maintenance services, 0.763) and B5 (container storage services, 0.719).

As indicated by Roso et al. (2009), dry ports are anticipated to provide sufficient value adding services for their users. Based on the interview outcome, Penang Port preferred PBCT to provide a range of value-adding services to their users for minimising the congestion at the seaport. In contrast, NIP and ICT linked to all major seaports provide a range of services to the users, assorting, mixing, blending, packaging, labelling and services advices to consignees (FIP1, FIP4, FIP5, FIP6 & FIP9). The ability of NIP and ICT to provide a range of value adding services has been proven to be the main attraction for seaports and other users towards these terminals (FIP 1 & FIP 9).

SIP dry port provides container handling services, logistic services and shipping services. However, the initiative of SIP in providing extensive services such as warehousing, consisting of stuffing, unstuffing, consolidation, packing, repacking and relabeling, has attracted so many users that its capacity could be even further utilised. Providing value adding services at the nearest perimeters to the users, dry ports may attract more users to their services and gain various advantages from that. Moreover, interviewees from the seaport authority and the Ministry of Transport suggested that SIP and PBCT benchmark NIP and ICT for further improvement in value adding services to improve their performance in the container seaport system.

Malaysian freight transportation is greatly dominated by truck, compared to rail, by the proportion of 98:2 (Chen et al. 2015). This shows that all users in dry ports have limited multimodal options and are highly dependent on road freight. Predicated on this scenario,

most of the dry ports have focused on road freight and have provided less attention to rail freight which has caused the services for rail-truck transfer to remain undeveloped compared to truck-truck transfer services. Both of these facilities need to be established equally to improve dry port ability to provide transfer services at their terminals. For example, NIP has no rail-truck services but it is located near the national rail grid. However, at SIP, the rail-truck services remain underutilised because of limited facilities. Connecting the NIP terminal to the rail grid and improving the facilities at SIP will be required for these dry ports to provide the benefits of modal split to their users.

A container maintenance service is one of the most important services that dry ports need to provide in addition to value-adding services, customs and multimodal options (Ng & Cetin 2012). In the Malaysian context, this study has made a similar finding to that from the literature, i.e. that container maintenance services have influenced dry port operations in Malaysia. Interviewees for this study have also identified container maintenance services in Malaysia as being categorised as miscellaneous requisites under operational infrastructure, which include cleaning, repairing and managing them. Currently, NIP and ICT are two dry ports that provide these services to their customers. However, PBCT and SIP are unable to provide this service due to space, facility and staff limitations. This shows that not all Malaysian dry ports meet the prerequisites of container maintenance services for operations.

Space for laden and empty container storage influences dry port operations in Malaysia. Limitations of land at PBCT and NIP have restricted these dry ports in providing storage for empty containers. Fortunately, NIP owns some land which potentially can be utilised as an empty container yard in the future. On the other hand, ICT has no land space for future development. Limitations of container storage services at PBCT have affected the volume

of inland transshipment containers from Thailand as well as reduced the container volume to Penang Port and Port Klang. These kinds of space limitations hinder dry ports from achieving their main objective of accelerating national and international trade. As the majority of interview participants (91%) expressed, Malaysian dry ports are able to increase their container volume to seaports, but space limitations for container storage will affect the efficiency of the container seaport system.

7.6.2.4 Government policy

The government policy factor consists of three items, B25 (multimodal transport infrastructure development policy, 0.927), B26 (seaport policy-land side transportation, 0.904), and B24 (cabotage policy, 0.732) which influences dry port operations in Malaysia.

Multimodal transport policy balances rail and road freight transportation and eases traffic congestion, lowers carbon emissions, and reduces distribution costs and times (Horst et al. 2011). The significantly imbalanced road and rail freight transport system (98:2) in Malaysia requires a sound multimodal transport infrastructure development policy to facilitate the freight task. In addition, the implementation of multimodal development should be applied equally to all states to provide better trade volume to seaports and to assist dry ports in increasing their capacity to manage container freights in the container seaport system. For example, the border dry port PBCT has a high potential for managing transshipment containers from Penang Port and Port Klang to Thailand and Singapore and vice versa. However, that dry port can only utilise such an opportunity by implementing an equal multimodal development policy rather than a mainly road transport policy.

The development of land side transportation is one of the main objectives of the national seaport policy. This policy was developed parallel to the seaport industry for effective

inland transportation systems (Mak & Tai 2010). Currently, PBCT, ICT and SIP are connected via multimodal transportation to seaports, while NIP relies on road only. Moreover, the imbalanced proportions between road and rail in freight transportation hinders the efficiency of modal split in the transport chain of Malaysia, limiting dry ports in assisting seaports for last mile delivery via the dry port. Therefore, continued improvement in and development of land side transportation especially with wide roads and railway networks is expected by dry port users. The implementation of this policy will also improve land side transportation by improving intra-state rail on the east coast to cater to the east coast container market from the South China Sea through to Kuantan Port (the container seaport on the east coast peninsular of Malaysia).

Cabotage policy encourages coastal shipping by national registered vessels and increases the incorporation of local companies in domestic shipping. The implementation of cabotage policy increases the container volume at a seaport and subsequently creates a need for dry ports. Accordingly, cabotage policy in Malaysia may provide great potential for enhancing the utilisation of SIP, and it guarantees sufficient containers to it. This policy aims at serving national trade development and increasing the demography of Malaysia's short sea shipping population. Although for this policy it has been argued that it is no longer relevant for globalisation, the encouragement of short sea shipping (SSS) activities is expected to provide extensive benefits for the development of dry ports, which has been proven beneficial in Chile and Nigeria.

7.6.2.5 Hinterland conditions

The factor of hinterland conditions consists of items B3 (rail connectivity, 0.799), B2 (road connectivity, 0.770) and B4 (cooperation with seaports, 0.543).

The availability of road connections in every dry port has become an advantage for freight distribution, compared to rail links which have limited connection to 3 dry ports and particular regions in the peninsular Malaysia. However, road connectivity between dry ports and seaports are not at a satisfactory level because of the domination of narrow and thinly paved roads which are not suitable for freight transportation. Due to the limited rail network and highways, most hauliers utilise state roads and put a lot of pressure on them. As a consequence, road connectivity especially at Port Klang is severely damaged and this is in turn is affecting the connectivity between seaports, dry ports and dry port users such as the seaport authorities, the freight forwarders, hauliers, shippers and manufacturers.

According to the interview participant FIP5, inefficiency of road and rail connectivity has affected container distribution in the metropolitan cities of Kuala Lumpur, Penang and Johor. Road and rail connectivity between seaports, dry ports and their users needs to be improved to reduce congestion in the city, the pressure on state roads and to increase efficiency in container transportation within and between cities.

The differences in connectivity coverage arise mainly because the proportion of the total road length is 50 times lengthier than the railway track. This situation reveals the importance of road connectivity in freight transportation compared to rail connectivity. Nevertheless, some implications arise as a result of high dependency on a single mode of transport in the freight system. For example, delays at PBCT are due to the high dependency of road transportation because of low capacity and frequency of train services and the limited railway tracks. Hence, the focus on the transport connection should be in equal balance with other components in container seaport systems to ensure effective connectivity between the foreland and the hinterland.

Cooperation between Malaysian container seaports and dry ports provides numerous benefits especially in last mile delivery, such as reducing congestion near seaports and expediting container rotations. All three major Malaysian container seaports are investors in dry ports, and therefore, competition between seaports and dry ports affects dry port performance in the container seaport system. For example, competition between SIP dry port and PTP seaport has caused the facilities in the dry port to remain underutilised. In contrast, cooperation between PBCT and Penang Port has enhanced the performance of both of these terminals by catering to domestic and international users. Similarly, cooperation with dry ports especially at ICT and NIP has provided fast container supply and clearance, assisting the seaport to enhance competitiveness by reducing vessel turnaround time and container dwelling time, and it has generated more revenue for North Port.

As the interview findings indicate, Malaysian dry ports are expected to play the role of an extended seaport, regional intermodal nodes, and interface terminals inland. However, dry ports are not well recognised by the community and key stakeholders. Cooperation with seaports should be able to help dry ports fulfil these roles, increase recognition and reduce their competition with seaports. A seaport operator interview participant (FIP11) suggested that dry ports need to operate with sufficient railway linkages and to possess and operate sufficient high-tech facilities and infrastructure so that cooperation with seaports can generate mutual benefits.

7.6.2.6. Location

Item B1 (the location of a dry port near a border, seaport or an industrial zone, 0.805) is the only item generated by the EFA to indicate that the location of dry ports influences its operations in the container seaport system.

The location of dry ports at borders between both Singapore and Thailand is an added advantage for dry port operations in Malaysia. These two regions are Malaysia's most important trading partners, and the location of dry ports near to these regions has encouraged inland transshipment between Thailand-Malaysia-Singapore. NIP and ICT dry ports are located near the manufacturing zone and have become the main platform for container de/consolidation. The location of dry ports near manufacturing areas has also encouraged container trade development in Nilai and Ipoh.

Additionally, the linkage with freight corridors has provided additional advantages for dry port operation. For example, PBCT and ICT are located along with northern east coast freight corridors and IMT-GT. NIP is connected with the central and east coast freight corridors as well as IMT-GT. Finally, SIP is connected with southern and east coast freight corridors and IMS-GT. The location of these dry ports provides a continuity in container volume to them from this strategic hinterland, because well positioned dry ports attract customers.

Even though SIP is located in the economic corridor cluster, some problems such as competition from hauliers and seaports, exposure to environmental issues such as flood and less connection to the east coast market have resulted in inconsistency in container volume to SIP. At this stage, the development of an intra-regional multimodal network, especially the Singapore-Kunming Rail Link (SKRL) has closed the gap between the seaports and dry ports. The integration between dry ports and the intra-regional network has overcome the location issue of the dry port and utilised the freight corridors to improve their contribution to the users.

7.6.2.7 Administration

Finally, item B9 (customs immigration and police inspection services, 0.881) is the only item extracted as an administrative function which is important for ensuring the safety and security of dry port operation.

Customs clearance, immigration and police inspections were perceived by respondents as important factors, confirming the findings in the literature that these services are the most crucial services provided by dry ports. All of the four dry ports in Malaysia provide customs clearance services, which has affected traffic congestion at Port Klang, PTP and Penang Port. As a consequence, moving this service towards the inland has provided time and cost benefits to the shippers, especially from the northern to southern regions of peninsular Malaysia.

The outdated clearance infrastructure at PBCT, a lack of customs staff at checkpoints and repeated customs procedures at Malaysia and Thailand's border check points take physical checking time from between 6 hours to 5 days (NCIA 2011), which has affected the efficiency of container transportation from dry ports to respective seaports in Malaysia. This evidence justifies why an efficient customs clearance service is perceived as one of the most important factors for Malaysian dry port operations.

The issue of smuggling and the entrance of illegal immigrants at borders are of some concern at the Malaysian-Thailand border and these can be avoided by stricter procedures by immigration and the police department. Besides the illegitimate entrance of cargo, the entrance of illegal immigrants causes the spreading of diseases and social issues in Malaysian territory.

The previous sections analysed and discussed the findings for the influencing factors of dry port operations, and the next section will present the EFA results and discuss the impact of dry ports on container seaport competitiveness.

7.7 The impact of dry ports on seaport competitiveness

Similar to the previous section, the suitability of the data for this section was examined before performing the EFA, to ensure the validity and reliability of the results. The values of the correlation coefficient among the variables in section C were at a moderate level (+/- 0.3). All the items met the assumptions and are strong enough for factor analysis as they produced high extraction scores (between 0.5-0.8) for communalities (see E.7 in Appendix E). The Kaiser-Meyer-Olkin index was 0.795 and the Bartlett's Test of Sphericity was statistically significant ($p < 0.05$) (see Table 7.13).

Table 7.13: KMO and Bartlett's Test (initial run)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.795
Bartlett's Test of Sphericity	Approx. Chi-Square	1012.177
	Df	120
	Sig.	.000

Sixteen variables were identified during the literature review and interview procedures. At this stage, the identified variables will be reduced into several components to draw a clear conclusion on the impacts of dry ports on seaport competitiveness. During factor extraction and varimax rotation, five components were identified with the loading value at more than 0.5 for further discussion (see table 7.14). Five components demonstrated the cumulative percentage of variance of 76.66 % and a total of five variances had an eigenvalue > 1 .

Table 7.14: Total variance explained for responses in Section C of the survey

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	5.687	37.913	37.913
2	1.773	11.821	49.735
3	1.571	10.474	60.209
4	1.365	9.098	69.307
5	1.104	7.358	76.665
6	.766	5.107	81.772
7	.575	3.835	85.606
8	.450	3.002	88.608
9	.358	2.389	90.997
10	.329	2.195	93.192
11	.298	1.984	95.176
12	.235	1.567	96.744
13	.171	1.138	97.882
14	.163	1.089	98.972
15	.154	1.028	100.000
Extraction Method: Principal Component Analysis			

In general, all extracted components have average loading values between 0.6-0.9. In the first component, five factors have combinations of very good and excellent loadings (between 0.6-0.8). The second component has three excellent loading factors (more than 0.8). Meanwhile, the third component has three factors ranged as excellent loadings (more than 0.8). The fourth component has two factors with excellent loadings (between 0.8-0.9). The fifth component has two factors with excellent loadings (0.8). Table 7.15 shows the loadings of each component.

Table 7.15: Rotated component matrix (showing all values)

	Component				
	1	2	3	4	5
C3. Increase seaport efficiency	.860	.163	.144	.096	-.007
C4. Reduce inland distribution costs	.829	.245	.042	-.103	.030
C5. Increase berth productivity	.728	.231	.092	.232	-.028
C2. Increase seaport reliability (stability and quality of service)	.710	-.002	.200	.262	.187
C1. Increase ship call frequency	.603	.057	.213	.149	.375
C14. Increase supplementary services for seaports	.153	.877	.104	.017	.131
C15. Shift value adding services of seaports inland	.214	.871	.175	.193	.076
C16. Support seaport flexibility	.182	.821	.176	.212	.111
C8. Increase accessibility to and from seaports	.156	.161	.839	.171	.187
C9. Improve seaport hinterland connectivity	.185	.088	.811	.134	.197
C6. Expand seaport hinterland transport networks	.114	.164	.765	-.007	.069
C13. Increase volume of containers for inland transshipment	.140	.169	.120	.905	.107
C12. Increase continuity of containers to seaports	.202	.164	.112	.888	.081
C10. Provide additional facilities for seaports	.044	.072	.221	.129	.856
C11. Provide additional space for seaports	.128	.186	.135	.036	.853

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Outcomes from the literature review and the interview sessions related to the impacts of dry ports on container seaports were utilised for component labelling. The five components are labelled subsequently as an enhancement to seaport performance, an increase in service variations for seaports, improvement in seaport-hinterland proximity, and an increase in seaport trade volume as well as an enhancement of seaport capacity.

7.7.1 Validity and reliability of EFA results

The Cronbach's Alpha coefficient as the measurement for reliability indicates that the value for rotated variables is 0.852 (enhancement in seaport performance), 0.897 (increase in service variations for seaports), 0.810 (improvement in seaport-hinterland proximity),

0.884 (increase in seaport trade volume) and 0.778 (enhancement in seaport capacity), indicating high reliability of the results and accuracy in the measurement procedure (Rudner 2001) (see Table 7.16). The EFA produced a five-factor model with 15 factors that reflect the impact of dry port operations on container seaport competitiveness. All the factor loadings met the threshold that the convergent validity was 0.5 and above and all the eigenvalues for the five factor model were greater than 1.

7.7.2 Discussion of results

The outcomes from the EFA for this section consisted of five main impacts of dry ports on container seaport competitiveness. These are the enhancement in seaport performance, an increase in service variation for seaports, an improvement in seaport-hinterland proximity, an increase in seaport trade volume and an enhancement in seaport capacity. These are discussed in the following sections.

7.7.2.1 Enhancement in seaport performance

The first impact arising from dry port operations on seaport competitiveness is the enhancement of seaport performance, consisting of items C3 (increase seaport efficiency, 0.860), C4 (reduce inland distribution costs, 0.829), C5 (increase berth productivity, 0.728), C2 (increase seaport reliability, 0.710) and C1 (increase ship call frequency, 0.603).

Table 7.16: Reliability test for EFA results (Section C)

Outcomes from EFA	Impacts of dry ports on seaport competitiveness	No of items and Cronbach alpha
Enhancement in seaport performance	C3. Increase seaport efficiency C4. Reduce inland distribution costs C5. Increase berth productivity C2. Increase seaport reliability (stability and quality of service) C1. Increase ship call frequency	5 (0.852)
Increase in service variations for seaports	C14. Increase supplementary services for seaports C15. Shift value adding services of seaports inland C16. Support seaport flexibility	3 (0.897)
Improvement in seaport-hinterland proximity	C8. Increase accessibility to and from seaports C9. Improve seaport hinterland connectivity C6. Expand seaport hinterland transport networks	3 (0.810)
Increase in seaport trade volume	C13. Increase volume of containers for inland transshipment C12. Increase continuity of containers to seaports	2 (0.884)
Enhancement in seaport capacity	C10. Provide additional facilities for seaports C11. Provide additional space for seaports	2 (0.778)

Container trade in Malaysia has shown a growth trend, and recorded almost balance in container trade transactions (MOT 2015). Therefore, container seaports should be able to manage container movement rapidly to meet the growing demand from customers for seaport services. Dry ports perform as an extended seaport inland, and carry out a customs clearance function as well as provide space for undertaking relevant logistic functions. This has improved seaport capacity and reduced the waiting times of moving containers at them. In addition, dry ports provide space to manage empty containers and transform them into laden boxes when there is a demand from the shippers/manufacturers. As interview participants (FIP3, FIP5, FIP6, FIP8 & FIP10) expressed, dry port storage and management of empty containers can improve traffic congestion to seaports owing to a

reduction in the moving of empty containers by hauliers to them. Several participants (FIP4, FIP8 & FIP9) also indicated that the emergence of dry ports in the container seaport system has enhanced seaport efficiency and reduced inland distribution costs.

The availability at dry ports of various transport connections for modal split from one mode to another affects the competitiveness of the product in the market (Wisetjindawat et al. 2007). In Malaysia, it is evident that modal split in container delivery via road and rail to seaports has provided cost benefits to the stakeholders and retained the competent price of the product in the market. As stated by a participant:

The incorporation of multimodal transportation at a dry port manages to reduce the freighting cost and reduce the market price of the cargo/goods at the destination (FIP7).

The ability of dry ports to enforce modal split activities especially in PBCT and ICT has enhanced seaport efficiency by faster container movement to and from Penang Port, Port Klang and PTP without excessive charges for inland distribution costs.

Dry ports which are able to replicate seaport functions inland greatly benefit users and subsequently affect the competitiveness of seaports. For example, the ability of ICT and NIP to provide comprehensive value adding services and customs clearance, has reduced the interference of inland clients at Port Klang, PTP and Penang Port, reducing secondary activities in the seaport and assisting it to increase their concentration on core activities. By this kind of pressure reduction, service reliability at the seaport has improved due to seaport functions being carried out by dry ports far away from the seaport territory. In the central region, the reliability of the services being provided by NIP has significantly reduced congestion caused by hauliers at West Port and North Port. This is because reliable clearance procedures and value adding services are provided away from the

seaport territory which has subsequently reduced the waiting time of seaport clients inland of the seaport territory.

Dry ports assist container seaports in providing customs clearance, managing laden and empty containers, and through value adding activities, therefore seaports gain more space capacity for operations. As a result, berth efficiency improves, resulting in an increased number of vessels calling at seaports (FIP10). This occurrence proves that dry ports can improve seaport berth productivity which then benefits shipping lines. Shipping lines have to spend almost USD 125,000 for a container vessel per day including capital, interest on loans, crewing, maintenance, bunker costs, canal costs, seaport costs, insurance, and other miscellaneous costs. Hence, dry port operations enhancing berth productivity thereby helps to reduce possible financial costs resulting from demurrage charges at seaports which is imposed on shipping lines.

On average, about 52% of vessels worldwide call in at ports with a one day delay. The vessels at trunk routes from or to the Asian region experience a reliability level of below 40% in meeting their ETA and they consume a transit time of more than 3 days (Vernimmen et al. 2007). Dry port operations improve seaport efficiency and berth productivity as discussed previously in this section, and contribute to seaport schedule reliability and also benefit shipping lines. As a result, they may attract more ship calls. This argument is supported by 55% of interview participants.

For example, the rapid movement of containers from West Port at Port Klang to NIP dry port has provided berth availability for vessels without lengthy waiting times. The availability of multimodal transportation facilities especially in PBCT and ICT has assisted seaports to clear containers from the seaport territory and simultaneously prepare for the

following vessel. However, the performance of dry ports could be better if the frequency of rail freight and the development of a rail network for the inter-state could be increased.

7.7.2.2. Increase in service variations for seaports

The second impact of dry port operations on seaport competitiveness is in increasing the variation in seaport services. This factor consists of items C14 (increasing supplementary services for seaports, 0.877), C15 (shifting value adding services of seaports inland, 0.871) and C16 (support seaport flexibility, 0.821).

Supplement services refer to a variation in services provided by a dry port to seaport clients in inland, such as in warehousing, storage and transportation services and customs services. Space limitations and time factors limit seaports in providing a range of services, and if they do, this will affect their core activity, which is container transloading. This is evidenced in the fact that Penang Port has urged PBCT to provide more services in addition to customs clearance to cope with space limitations, delays and congestion at Penang Port. On the other hand, NIP and ICT dry ports are able to provide supplementary services such as logistic services and transport equipment control services. These services have made dry ports attractive to stakeholders, including seaports to be utilised. Therefore, all seaport users may deal with dry ports to fulfil their various demands without approaching seaports. Accomplishing various demands according to user request inland improves the flexibility of seaports serving their respective users at various locations.

However, at PBCT, a range of customised services and also customs clearance is provided but without sufficient physical infrastructure such as office buildings, and with obsolete clearance infrastructure and delays in container clearance procedures from Thailand. Due to time limitations, the entire container is arranged without refereeing the container

arrangement plan on the rail deck. This situation prevents PBCT from excelling in the container seaport system and it eventually affects Penang Port's competitiveness by increasing vessel turn-around time. PBCT needs sufficient operational infrastructure, personnel requirements and capital infrastructure as indicated in the qualitative findings to provide supplementary services effectively inland.

Providing value adding services is one of the important dry port functions as well. In Malaysia, the increased volume of containers as a result of globalisation has caused Port Klang, PTP and Penang Port to face issues such as congestion, delays and increased container transportation costs. Hence, providing a range of value adding services at dry ports rather than at seaports can help them cope with the abovementioned issues. The provision of value adding services at a dry port improves the competitiveness level of the seaport and the dry port's competency among other dry ports. The ability of the dry port to provide value adding services inland at NIP and ICT, has reduced the pressure at the seaports to provide value adding services.

Roso (2008) argues that dry port operations increase a seaport's flexibility to respond rapidly to the needs of different clients. The finding of this research in the Malaysian context is consistent with this argument. As mentioned earlier, Malaysian seaports Port Klang, PTP and Penang Port have had issues of space constraints and congestion. Hence, the assistance of dry ports in providing supplementary or value adding services can assist seaports to become more flexible in operations for their customers, for example, by having more space and berth capacity. Moreover, the utilisation of the dry port for immediate container placement for delayed shipping liners is a major attraction for shipping lines. This situation clearly reflects the fact that dry ports can manage to perform in the container

seaport system by transforming the rigidity of seaports towards flexible and customer orientated terminals.

However, the inability of a dry port to provide competent services to their users can make the seaport unable to gain the full benefits from the existence of dry ports and it can reduce the seaport's opportunity to be flexible for their respective clients. For example, the limited performance of SIP has provided less benefit to PTP and Port Klang, and has prevented users in the southern region from utilising this dry port. This is a major threat to PTP because shipping lines might prefer seaports from neighbouring regions such as Indonesia, Thailand and Singapore compared to it.

7.7.2.3. Improvement in seaport-hinterland proximity

The third impact of dry port operations on seaport competitiveness is in improving seaport-hinterland proximity. It consists of items C8 (increase accessibility to and from seaports, 0.839), C9 (improve seaport hinterland connectivity, 0.811) and C6 (expand seaport hinterland transport networks, 0.765).

The accessibility from a seaport inland enlarges the parameters of a seaport's hinterland market. The component of multimodal freight in Malaysia, including road and rail to assist seaports has increased their access to the hinterland market via dry ports. The role of this dry port as an interface terminal inland has assisted seaports in connecting with manufacturers through various modes of transportation, roads, highways, rail networks and in particularly Landbridge rail freight services to and from Thailand. These transport networks provide better accessibility for seaports to the hinterland.

However, there is a need to improve accessibility at the ICT and NIP dry ports. ICT is facing some issues for short distance container transportation, and NIP depends on a single

mode of transportation. Moreover, accessibility on the west coast of Malaysia is more advanced than on the east coast of peninsular Malaysia. Therefore, equal development of both freight transportation modes are required in northern, east coast, central, west coast and southern regions of peninsular Malaysia to increase the accessibility to and from seaports.

Intermodal connectivity in each seaport needs to be utilised to overcome congestion, delays and to make them cost effective (Roso & Lumsden 2010). The connectivity between seaports and dry ports needs to be focused by balancing their transportation modes and ensuring that they may provide all those benefits not only to seaports, but also to other users. The finding of this study shows that some dry ports in Malaysia such as PBCT, ICT and SIP utilise road and rail networks to connect seaports with their hinterlands, despite the fact that the rail networks and services should be further enhanced.

Expanding seaport-hinterland transport networks refers to widening the seaport's existence in inland to cater for needs of different users. This element is highly anticipated by seaport clients for reducing congestion issues at seaports, especially at Port Klang, PTP and Penang Port, and to gain cost and time benefits during container transportation to and from the seaport.

Dry ports have the ability to expand the seaport-hinterland transport network far into the hinterland and thereby increase seaport competitiveness. Besides seaports, several Malaysian dry ports have managed to integrate the application of multimodal transportation under a single roof to expand their seaport transportation network. For example at PBCT and ICT, the combination of rail and road freight has improved the transportation network from seaports to end users via dry ports. Expanding this network indicates that dry ports are playing an active role as an interface terminal inland for seaport

users although they face some restrictions in the coverage of multimodal transportation in improving the proximity between seaports and the hinterland. Almost 73% of participants during the interview session indicated that dry ports function as an interface terminal inland for rail and road transportation and are thus expected to increase the consistency in freight trips between seaports and dry ports and expand seaport hinterland transport networks.

7.7.2.4 Increase in seaport trade volume

The fourth impact of dry port operations on seaport competitiveness is in improving seaport trade, and consists of items C13 (increase volume of containers for inland transshipment, 0.905) and C12 (increase continuity of containers to seaports, 0.888).

Manufacturers from regions beyond the Malaysian border also take part in Malaysian dry port operations and enhance the container volume to its seaports. PBCT is retaining a healthy business relationship with manufacturers from the southern region of Thailand. It is clear that the dry port in this region is focused on the enhancement of container volume to and from seaports by optimising the role of cross border transshipments in its operations.

Dry ports are not at the optimum level to assist seaports in handling transshipment containers because of limitations in space and in multimodal transportation. Malaysian dry ports located in between Singapore and Thailand that handle transshipment containers to and from these regions are not satisfied because of the poor frequency in the landbridge at the Malaysia-Thailand border and the unavailability of rail freight at the Malaysia-Singapore border. Interview participants (FIP5) indicated that the main role of a dry port is to accelerate national and international business by increasing container volume from international border transactions between neighbouring countries, especially between

Thailand, Singapore, Cambodia and Myanmar and Malaysian seaports. The advantage of dry port locations needs to be utilised to reduce the dependency on container seaports for handling transshipment containers.

The unavailability of rail freight facilities to Singapore, the limited capacity of rail freight at the Malaysian-Thailand border and the inadequate frequency of Malaysian-Thailand rail trips has limited dry ports in executing container transshipments beyond the Malaysian landmass. However, the development of rail freight in Malaysia as well as beyond this region may provide an additional advantage for Port Klang, PTP and Penang Port for increasing inland transshipment containers from dry ports.

The availability of domestic manufacturers near NIP and ICT has encouraged most of their users to take advantage of these intermodal terminals during their freight transportation. Both of these dry ports are categorised as city-based dry ports, and serve manufacturers especially from Ipoh, Malacca, southern Selangor, Seremban and northern Johor. The aim of manufacturers is to utilise these facilities and avoid excessive freight costs and experience less time duration to reach and exit seaports, however, they generate a continuity of containers to these seaports.

The existence of manufacturers near PBCT, ICT and NIP has encouraged these dry ports to channel their container volume to their respective seaports. Poor numbers of manufacturers near SIP have created a contradictory situation compared to other dry ports, and there has been a decrease in the number of containers transported to PTP or Port Klang via this dry port every year. The development of inter-regional economic plans such as the IMT-GT and IMS-GT provide an opportunity to the private sector from various countries in South East Asia to invest as manufacturers near to a dry port and increase the continuity of container volume to seaports.

7.7.2.5. Enhancement in seaport capacity

The final impact of dry port operations on seaport competitiveness is by amplifying the seaport's capacity, consisting of items C10 (provide additional facilities for seaports, 0.856) and C11 (provide additional space for seaports, 0.853).

Dry ports without sufficient facilities like seaports will be worthless in attracting more stakeholders to utilise them. A high quality of facilities is required at dry ports so that they can proceed with safe operation procedures and replicate seaports inland, and attract more seaport clients to these terminals. However, in this region, all dry ports operate under a low capacity in terms of machinery. Although dry ports are equipped with basic machines such as stackers and forklift, they still lack tractor-trailers, rubber-tired gantries and rail-mounted gantries, which affects the operations and reduces the potential of the dry port to replicate functions of seaports inland. Besides machinery, the application of X-ray scanners and explosive detection equipment will be an added advantage for them in executing container transactions at border based areas. The inability of seaports to provide these facilities due to space and time restrictions makes dry ports competitive by their ability to provide these facilities inland. Furthermore, it enhances seaport capacity.

Seaports are facing severe pressure to attract and to accommodate mega vessels from shipping alliances. This situation has caused all major container seaports to plan for land reclamation. Providing additional space inland, and creating an effective inland network through dry ports can reduce the pressure on seaports in facing this new dynamic in this industry, and help them overcome land reclamation issues. The ability of seaports to cooperate with dry ports and practice location pooling can provide additional strength for them to ensure a sufficient volume of containers from inland fill the substantial space in

the mega vessels as per schedule, and avoid substantial implications arising from global shipping alliances.

According to the seaport operator interviewee (FIP 10), seaports in Malaysia have required additional space to improve container volume and reduce congestion at seaports. The space capacity at Port Klang, PTP and Penang Port are almost at optimum levels, and requirements for space are critical. Therefore, Malaysian dry ports which provide a range of seaport functions can greatly improve seaport capacity in accommodating high volumes of container from gigantic liners, and thus maintain their competitiveness.

7.8 Dry port influencing factors and seaport competitiveness

After validating the influencing factors of dry port operations and the impacts of these intermodal terminals on container seaports, the next stage is to examine the relationship between them to identify which influencing factor provides a significant impact on Malaysian container seaport competitiveness. A multiple regression analysis was conducted to indicate the regression coefficient (β) on how strong the relationship or goodness of fit (Keith 2006) is between dry port influential factors and their impacts on seaport competitiveness. The (z) value was derived from EFA to determine the regression coefficient between influential factors of dry ports and their impacts on seaport competitiveness (see Table 7.17). During the regression analysis, the influential factor of dry port classified as dependent variable and the impacts on seaport competitiveness become independent variable.

The outcomes of multiple regression based on coefficient of determination values (r^2) indicates that Malaysian dry ports significantly enhance seaport performance ($r^2 = 0.258$, $p = 0.000$), increase the variation of seaport services ($r^2 = 0.184$, $p = 0.002$), and improve

seaport-hinterland proximity ($r^2 = 0.117$, $p = 0.046$) (see E.8 in appendix E). This shows that the main implications of dry ports in Malaysia are only focused on these three dimensions.

Table 7.17: Results of multiple regressions on dry ports and seaport competitiveness

Container seaport competitiveness Influencing factors of dry ports	1. Enhancement in seaport performance	2. Increase in service variations for seaports	3. Improvement in seaport-hinterland proximity	4. Increase in seaport trade volume	5. Enhancement in seaport capacity
Coefficient of determination value (r^2)	$r^2 = 0.258$ $p = 0.000^*$	$r^2 = 0.184$ $p = 0.002^*$	$r^2 = 0.117$ $p = 0.046^*$	$r^2 = 0.033$ $p = 0.804$	$r^2 = 0.049$ $p = 0.568$
2.Capacity	$\beta = 0.072$ $p = 0.380$	$\beta = 0.194$ $p = 0.025^*$	$\beta = 0.135$ $p = 0.130$	$\beta = 0.040$ $p = 0.669$	$\beta = 0.102$ $p = 0.268$
1.Information sharing	$\beta = 0.262$ $p = 0.002^*$	$\beta = 0.082$ $p = 0.339$	$\beta = 0.072$ $p = 0.421$	$\beta = -0.015$ $p = 0.875$	$\beta = 0.152$ $p = 0.101$
3.Service features	$\beta = 0.121$ $p = 0.141$	$\beta = 0.171$ $p = 0.048^*$	$\beta = 0.181$ $p = 0.044^*$	$\beta = -0.122$ $p = 0.192$	$\beta = 0.077$ $p = 0.407$
4.Government policy	$\beta = 0.144$ $p = 0.079$	$\beta = 0.318$ $p = 0.000^*$	$\beta = 0.088$ $p = 0.322$	$\beta = 0.058$ $p = 0.531$	$\beta = 0.075$ $p = 0.415$
5.Hinterland conditions	$\beta = 0.316$ $p = 0.000^*$	$\beta = 0.019$ $p = 0.821$	$\beta = -0.056$ $p = 0.532$	$\beta = 0.025$ $p = 0.789$	$\beta = -0.002$ $p = 0.985$
6.Location	$\beta = 0.220$ $p = 0.008^*$	$\beta = -0.081$ $p = 0.348$	$\beta = 0.059$ $p = 0.376$	$\beta = 0.084$ $p = 0.370$	$\beta = -0.040$ $p = 0.668$
7.Administration	$\beta = 0.024$ $p = 0.772$	$\beta = -0.052$ $p = 0.547$	$\beta = 0.159$ $p = 0.029^*$	$\beta = -0.069$ $p = 0.458$	$\beta = 0.047$ $p = 0.611$

* Significant at 95% level of confidence

The regression coefficient values show that hinterland conditions ($\beta = 0.316$, $p = 0.000$), information sharing ($\beta = 0.262$, $p = 0.002$) and location ($\beta = 0.220$, $p = 0.008$) are the main factors that increase seaport performance. Secondly, government policy ($\beta = 0.318$, $p = 0.000$), the capacity of dry ports ($\beta = 0.194$, $p = 0.025$) and service features ($\beta = 0.171$, $p = 0.048$) at dry ports increase the variation of seaport services.

Finally, service features at dry ports ($\beta = 0.181, p = 0.044$) and the administrative function of dry ports ($\beta = 0.159, p = 0.029$) have significant influences on seaport-hinterland proximity. However, Malaysian dry ports provide insignificant implications on seaports trade and capacity. The reliance of seaports on their own capacity, dependency on the foreland container market and the uneven development of freight transportation have resulted in the realisation that Malaysian seaports are unable to utilise dry ports. This has caused seaports to be unable to gain substantial benefits from dry ports for improving seaport competitiveness, especially in trade volume improvements and capacity enhancement.

7.9 Summary

This chapter used EFA to analyse survey data collected for the quantitative phase of this research. Several procedures were selected to examine data suitability and to undertake assumption validation during the quantitative phase. The results indicated that factors influencing dry port operations consist of capacity, information sharing, service features, government policy, hinterland conditions, location and administration in dry ports.

Dry port operations in container seaport systems provide a significant impact on seaport competitiveness. Dry ports are expected to enhance the level of seaport competitiveness, especially in enhancing seaport performance, an increasing in service variations for seaports, an improvement in seaport-hinterland proximity, an increase in seaport trade volumes and in enhancing seaport capacity.

In the Malaysian context, container seaport performance is significantly influenced by information sharing, hinterland conditions, and the location of dry ports. Increases in service variations for seaports are influenced by capacity, service features at dry ports, and government policy. Finally, service features at dry ports and the administrative function of

dry ports have improved seaport-hinterland proximity. In general, all factors that influence dry port operations have a significant influence on these three elements of seaport competitiveness and have no significant impact on seaport trade and seaport capacity.

The findings in Chapter Four and Six have indicated that Malaysian dry ports have strengths, and face multiple challenges in the container seaport system. They also have many opportunities. Considering the influencing factors of Malaysian dry port operations and their impacts on container seaports in this chapter, the following chapter elaborates on how Malaysian dry ports can cope with the challenges, and utilise opportunities to enhance the efficiency and effectiveness of the Malaysian container seaport system. It aims to provide strategic directions for the future development of Malaysian dry ports.

CHAPTER EIGHT

STRATEGIES FOR

MALAYSIAN DRY PORT

DEVELOPMENT

8.1 Introduction

Chapter Four addressed that the Malaysian Government has been implementing economic development plans which are expected to contribute to the increase in the nation's freight tasks for domestic and international trade. These plans led to increasing demand for competitive container seaport systems. The findings in Chapter Six indicate that the Malaysian dry ports are to enhance trade development, encouraging multimodal systems in the nation, improving seaport competitiveness, encouraging regional economic development and establishing Malaysian seaport policy. Malaysian dry ports play roles as an extended seaport in inland, regional intermodal nodes and as an interface terminal between seaports and other clients in inland regions to achieve those objectives.

However, the findings from Chapter Six also revealed that Malaysian dry ports currently face several challenges. How dry ports can utilise the opportunity mentioned above through improvement and further development is important to facilitate the nation's freight task. This chapter aims to discuss the opportunities of Malaysian dry ports and provide strategies which can be adopted for improving dry port operations and future development to utilise these opportunities. It is to answer the third secondary research question as stated below.

SRQ3: What are the strategies for enhancing Malaysian dry port operations and further development?

The discussion in this chapter is based on the responses to interview questions in Part B, and findings from the literature review, qualitative and quantitative phases of this research.

8.2 Opportunities of Malaysian dry ports for future development

Interview participants indicated that Malaysian dry ports have opportunities for future development because of the accessibility to international transportation networks and the government's international and national economic development plans. The following sections provide an in-depth explanation about these opportunities and their implication for dry ports.

8.2.1. Accessibility to international transport networks

Malaysian dry ports are able to connect with other regions in South East Asia through rail and road networks. For rail networks, the Singapore-Kunming Railway Link (connecting Singapore, Malaysia, Bangkok, Phnom Penh, Ho Chi Minh, Vientiane, Yangon, Hanoi and Kunming), Trans-Asia Railway Link (connecting across Asia and Europe) and Malaysia-Thailand Landbridge (connecting Malaysia and Thailand) are three major networks connecting Malaysian dry ports. The North-South Expressway connects Malaysian dry ports with Thailand and Singapore through road networks. The majority of interviewees (91%) expressed that both transportation networks have exposed dry ports to international markets by, for example, encouraging the freight network between Thailand, Malaysia and Singapore. The connections provided by international transport networks offer a great advantage and an opportunity for dry port development to enhance the continuity in container trade to and from seaports in Malaysia.

The availability of these international transport networks provides the potential for fast container delivery and pick up from domestic and international freight markets and an increase in container volume in seaports is expected. However, the finding in Chapter Seven indicated that Malaysian dry ports do not significantly enhance seaport trade

volume. This implies that more effort needs to be expended into how to take advantage of the international transport network to gain more crossborder trade through the dry ports to seaports.

The recent idea initiated by the Chinese Government, One Belt One Road (OBOR), in 2013 may provide another opportunity for Malaysian dry ports. The OBOR initiative consists of trade and infrastructure development via land and maritime routes connecting East Asia with Europe (Hong 2015). The land route of this international transport network provides a bright future for Malaysian trade and contributes to the development and further improvement of the existing transportation infrastructure in Malaysia. Figure 8.1 shows how Malaysia is connected with the OBOR network.

The Singapore Kunming Railway Link and Trans-Asia Railway Link enhance the main opportunities for Malaysia to be involved in China's OBOR network. The OBOR rail link will start at Xi An and move towards Moscow and other parts of Europe (see Figure 8.1). According to Hong (2015), the main agenda of OBOR is to improve trade facilitation, exchange customs cooperation, integrate the application of e-commerce between nations and develop modern service in crossborder transactions. Therefore, utilising Malaysian dry ports in the container transactions may help to meet those objectives. Once the OBOR initiative is implemented, the container volume from China, Europe and South Asia can be transported by rail to Malaysia. In that case, Malaysian dry ports will be highly utilised to enhance the quality of crossborder transactions as well as improve the proportion of rail freight. By opening trade links with the OBOR network, the impact of dry ports on seaport trade volume and capacity, which currently is not significant, may be positive.

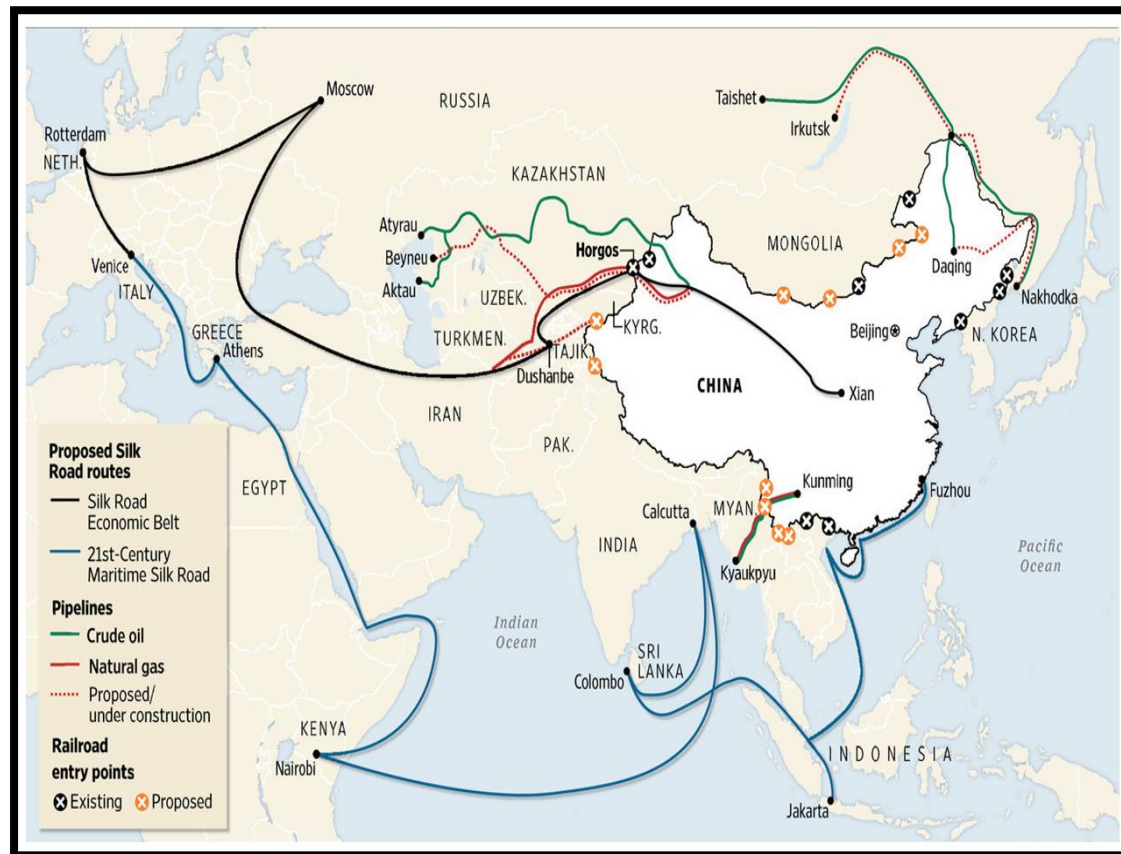


Figure 8.1: Malaysia connection with OBOR network
Source: Adapted from Jeremy (2014)

8.2.2. Government's international and national economic development plans

The locations of Malaysian dry ports along with international or inter-region freight corridors between Malaysia, Indonesia, Thailand and Singapore are a great opportunity for dry ports. As mentioned in Chapter Four, these international freight corridors or inter-region freight corridors, known as the Indonesia-Malaysia-Thailand Growth Triangle and the Indonesia-Malaysia-Singapore Growth Triangle, offer a substantial opportunity for Malaysian container seaport systems. As shown in Chapter Seven, the locations of Malaysian dry ports have a significant impact on container seaport performance. Utilising the development of the international economic corridors, the dry ports close to the border

such as PBCT (close to Thailand) and SIP (close to Singapore) will have a good opportunity to further enhance seaport competitiveness through the border transactions.

The development of national freight corridors is evenly focused on central, northern, southern and east coast regions. The focus of those corridors is to improve infrastructure and logistic sectors in Malaysia. There are ample opportunities around the regions along the freight corridors, and demand for efficient and effective freight transportation systems. However, the current limited rail services are not economically viable for a dry port to cater additional volumes of containers either from domestic or international markets. Therefore, the development of national freight corridors provides a good opportunity for the government to invest in rail freight infrastructure and improve rail freight, which will generate and balance the economic development especially in the north and on the east coast of Malaysia.

In general, the inland transportation component in Malaysia is dominated by road rather than rail. Based on the questionnaire survey results (question D2), the dry port users indicated that road and rail transportation were equally important for inland container transportation. This response indicates that dry port users demand both modes of transportation to gain competitive advantage, especially from time and cost perspectives. Hence, the exposure from international and national freight corridors can be utilised as an opportunity to develop rail freight transportation, reduce pressure on the road networks and provide significant benefits to dry ports.

The Malaysian Government has introduced the Logistics and Trade Facilitation Master Plan (2015–2020), which proposes the development of last-mile connectivity of seaports and the establishment of PPP for Malaysian rail operations and infrastructure investment (EPU 2015). The development of transport infrastructure in this plan offers opportunities

for equal development of rail and road freight transportation. Therefore, it will increase the connectivity between seaports and the hinterlands, including dry ports, and provide a great opportunity for seaports to cater to inland markets to enhance their capacity and trade volume in the future.

As indicated in the findings of the qualitative and quantitative phases of this research, the capacity of road and rail transportation are equally important in freight transportation in Malaysia. A balanced development of rail and road provides an opportunity for dry ports to enhance road connectivity and rail connectivity so as to have a bright future. The Logistics and Trade Facilitation Master Plan can also accommodate the development of national and inter-regional (South East Asia) freight corridors to promote national and regional economies.

Figure 8.2 positions Malaysian dry ports in relation to the two opportunities outlined above as well as previously mentioned opportunities. Accessibility to international transport networks is the combination of OBOR, the Trans-Asia Railway Link, the Singapore-Kunming Railway Link and the Malaysia-Thailand Landbridge. These networks provide an opportunity for Malaysian dry ports to be involved in crossborder transactions for the containers transported by rail from China, Europe, South East Asia and South Asian regions. In addition to the rail network, Malaysia is also well positioned for international trade via the road network. The North-South Expressway connects Malaysia, Thailand and Singapore. The Malaysian container seaport systems are exposed to international trade to and from inland regions by rail and by road.

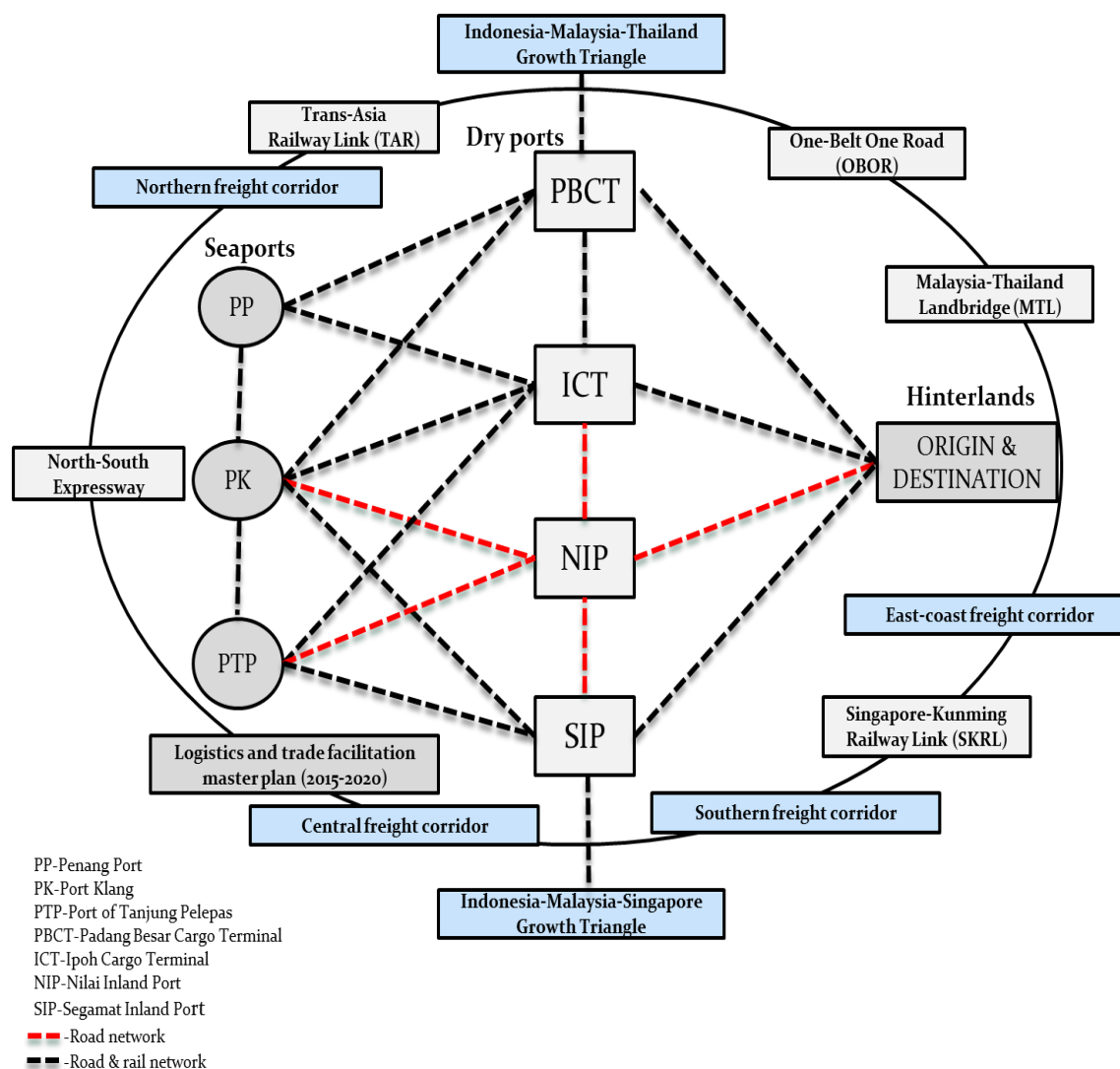


Figure 8.2: Prospects for Malaysian dry port development
Source: Author

The government's international and national economic development plans are the combination of the international plan and the national plan, both of which provide substantial benefits to Malaysian container seaport systems. Firstly, the international economic development plan is the combination of the Indonesia-Malaysia-Thailand Growth Triangle and the Indonesia-Malaysia-Singapore Growth Triangle. Both of these international development plans are intended to to facilitate and promote trade among the members, strengthen the infrastructure linkages to support integration, develop human resource competencies and enhance public-private sector collaboration, increase transport

infrastructure, particularly road and seaports, and streamline the customs procedures for freight transportation between these three regions (IMT-GT 2012; Humphries 2004).

The combination of these international plans with the national plan, such as the northern, central, southern and east coast freight corridors, provides a clear linkage between international and national connections. The aim of this national development plan is also aimed at improving the transportation system, infrastructure and human capital development. Therefore, Malaysian container seaport systems may utilise this opportunity to improve the rail network (double track), develop the road network (highways and wide roads) and upgrade the facilities in dry ports.

The accessibility to international transportation networks and the government's international and national economic development plans combined with the Logistics and Trade Facilitation Master Plan (2015–2020) promote the development of intermodal transportation within and beyond the regions. Strategies to improve the performance of dry ports in the container seaport system should be considered.

8.3 Strategies and recommendations for Malaysian dry ports' development

As indicated in Chapter Six, Malaysian dry ports possess the strengths of good locations, involvement of public and private sectors in development and operations, and transport connectivity. Given the opportunities addressed in the previous section, Malaysian dry ports have great potential to facilitate the nation's freight task in the future. Moreover, the findings from Chapter Seven show that Malaysian dry ports, as perceived by their stakeholders, provide benefits to container seaport competitiveness. However, as revealed in Chapter Six, there are some issues faced by Malaysian dry ports that are related to

transport infrastructure and operations, container planning, competition, location, and community concerns about social and environmental issues.

Hence, the extent and scope that dry ports presently contribute to container seaport competitiveness are limited to seaport performance, seaport services provision and expansion of container seaport hinterlands through someinfluencing factors of dry port operations including locations, providing capacity, information sharing and supplementary and value adding services, transportation connectivity, and government policies. Considering the utilisation of those opportunities by overcoming those challenges, this research provides strategies in the following sections for Malaysian dry ports' development and operations to enhance container seaport competitiveness.

8.3.1 Transport infrastructure and operation strategy

The main issues related to transport infrastructure and operations are insufficient rail services, imbalanced rail and road transport modal split, and road width. Strategies to solve these problems include the introduction of double track rails, providing options for east coast Malaysian freight transportation, increasing modal split, providing haulier service through vertical integration, milk-run logistic and utilisation of intra and inter-regional economic development.

8.3.1.1 Introduction of double track rails

In Malaysia, only 20% of the rail system is double track and 90% of the total tracks are narrow gauge (Amos 2009). As a result, the rail capacity is limited and it is not possible to increase the capacity easily. Hence, it is suggested to introduce more double track railways which will be helpful in improving the frequency and capacity of Malaysian rail systems.

This view has been expressed by all of the interviewees participating in this research in the qualitative phase.

At present, the capacity of Malaysian trains carrying containers is only 60 TEUs/trip, lower than the world average of 66 TEUs/trip recorded in 2011 (Woodburn 2011). According to the perceptions of Malaysian railway and seaport operators, as expressed in the interviews, it is anticipated that the introduction of double track railway would increase train capacity from 60 TEUs/trip to 120 TEUs/trip, which is likely to promote more rail freight volume in peninsular Malaysia. The introduction of an electrified double track system in 2008 in China has increased the capacity of rail freight up to 90%, providing good evidence that such a strategy would be successful (Bullock et al. 2009). The introduction of a double track railway system improves container handling capacity in dry ports and convinces more users to utilise the existing dry ports in the container transportation chain at the same time as accelerating the percentage of rail freight involvement in the freight transportation chain.

8.3.1.2 Providing options for east coast Malaysian freight transportation

One of the aims of dry ports is to decrease traffic on the roads by utilising the rail network (Daniela & Sciomachen 2014). However, this is impossible to achieve in the whole of Malaysia because container freight has been highly dominated by road transport rather than rail since 1996. The road freight biased trend shows that rail freight has been left far behind as compared to road freight and requires an urgent development plan, in particular on the east coast. The planning for rail link development should not concentrate solely on the west coast of peninsular Malaysia as it needs to be evenly developed around the nation. The structured and even planning of railway capacity would open a new market for Malaysian trade and improve the container volume of dry ports on the east coast of

Malaysia. It also could be capitalised upon to improve economic development, especially with regard to the East Coast Economic Region (ECER) Development Plan (Tenth Malaysia Plan 2011).

The development of train capacity strengthens the dual mode transport function in container delivery from seaport to clients. Further, the option for users to select their preferred mode of freight transportation reduces the pressure on roads and provides significant benefits for seaport trade volume. The initiative of the Logistics and Trade Facilitation Master Plan (2015–2020) can be utilised to develop rail freight transportation on the east coast of Malaysia. According to EPU (2015), this plan is expected to increase rail freight containers in Malaysia. Hence, this plan could be an opportunity for Malaysian dry ports to develop their rail links evenly across peninsular Malaysia.

8.3.1.3 Increasing modal split by increasing rail transport

It is important for dry ports to have appropriate modal split to gain cost reduction in freight transportation (FDT 2007), reduce the dependency on single mode transportation (Kapros 2003) and compete with seaports and inland depots (Ng et al. 2013). An example is Poznan dry port in Poland which connects with seaports and inland regions with a modal split of 42:58 between rail and road for container distribution, thereby benefiting the dry ports' clients and transport operators who are able to make decisions in allocating an adequate proportion of containers to both modes of transport (Fechner 2010; Kim et al. 2011). The almost equal container portion between road and rail provides efficient freight transportation to clients in different zones, reducing the freighting cost and also reducing the pressure on road freight transportation.

However, in Malaysia, currently the transport modal split between rail and road is about 2:98, which is very imbalanced. The dry port NIP is without rail connection and while SIP is close to a rail network it is without a rail terminal in the dry port. These dry ports need to be supported by investing rail infrastructure as PBCT and ICT have to improve the effectiveness of container delivery and pick up from various distances, cater to the east coast market and reduce the dependency on single mode freight transportation. To tackle the problem of an extremely imbalanced modal share, the government has projects in place to improve rail infrastructure, such as upgrading the single track rail to electrified double track systems in the north-south rail link, mentioned in section 8.3.1.1, to enhance the train capacity and increase the speed of container transfer to and from seaports and vice versa. When completed, the rail operator should increase the number of services linking seaports to hinterlands, including dry ports, and encourage stakeholders to utilise the rail network.

8.3.1.4 Providing haulier services through vertical integration

As indicated in Chapter Six, the dry port ICT has faced an issue that the haulier is reluctant to deliver containers to a short distance destination. This issue can be overcome by using vertical integration, i.e. dry ports own and operate their haulier services. It is suggested that ICT invests in the haulier business and provides its own transportation services for coordinating container distribution over short and long distances through road and rail transport respectively. Dry ports with their own haulier services avoid the issue that container delivery/pick up within the zone is considered to be non-profitable by external haulier providers. It also helps to build the trust between dry ports and their clients (Qin 2010b).

8.3.1.5 Milk-run logistic

The milk-run logistic approach is an alternative strategy for ICT if it is unable to invest in and own hauliers. Milk-run logistic is recommended to reduce the transportation cost, provide greater accuracy of just-in-time goods delivery, and improve the vehicle loading rate by implementation of high agility and flexibility (Chen & Sarker 2014). Milk-run logistic always begins with the longest distance and finishes at the shortest distance to the location of origin (Borjesson & Lindberg 2014). Thus, ICT may utilise a long-distance haulier to collect the containers from short distances.

Without milk-run logistic, 8 trips (T) are involved for the import (inbound containers) and export (outbound containers) processes through ICT (see Figure 8.3). For the import process, the trip starts from ICT to the seaport (T1 & T2), then distribution is made to zone 1 before returning to ICT (T3 & T4). The process occurs for zones 2 and 3 (T5, T6, T7 & T8). However, with the application of milk-run logistic, the trips are reduced from 8 to 6. During container import through ICT, the haulier will move from dry port to seaport and return to the dry port (T1 & T2). After customs clearance, the container will be directed to zone 3 (T3), then to zone 2 (T4), zone 1 (T5) and finally to the dry port (T6). During the export process, the haulier will collect the container from zone 3 (T1), proceed to zone 2, zone 1 and finally to ICT (T2, T3 & T4). After clearance and value adding procedures, the container will be transported to the seaport and then return to ICT (T5 & T6). Through this strategy, ICT can reduce the trips from 8 to 6 and overcome the short distance container distribution/collection issues during import and export. This strategy manages to utilise dry port existing capacity, improve the punctuality in container transportation as well as assist seaports to optimise dry ports' capacity to improve their trade volume.

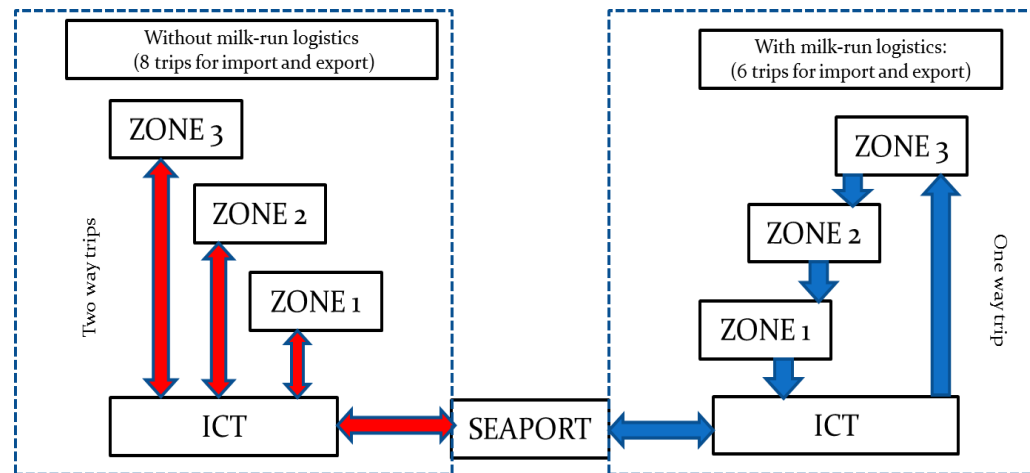


Figure: 8.3: Milk-run logistic at ICT
Source: Author

8.3.1.6 Utilisation of intra & interregional economic development

The intra-regional economic development plans North Corridor Economic Region (NCER) and Iskandar Malaysia (IM), focusing on northern and southern Malaysian regions, prioritise logistic and infrastructure development in these regions (Ngah 2010). Additionally, inter-regional economic development plans Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT) and Indonesia-Malaysia- Singapore Growth Triangle (IMS-GT) aim to strengthen infrastructure linkages, enhance public-private sector collaboration and generate investment in transport infrastructure especially on road, seaports and other freight transportation facilities (Humphries 2004; IMT-GT 2012). These economic development plans provide opportunities for the private sector, in particular foreign investors, to invest in Malaysia's transport infrastructure including dry ports. Therefore dry ports PBCT and NIP, which are within the freight corridors, should take this good opportunity to attract investment that would enhance their capacity to handle not only laden containers but also empty containers. The experience in Vietnam provides a good illustration of this strategy. The Government of Vietnam channelled high investment in infrastructure and transport corridor development to Vietnamese dry ports. As a result, 13

dry ports in Vietnam have sufficient capacity to handle 6 million TEUs by 2020 and 14 million TEUs by 2030 to support 150 seaports in the region (Nguyen 2014).

8.3.2 Container Planning

The main challenges faced by Malaysian dry ports are planning and managing containers due to unorganised containers on rail deck to seaports, and limited space for managing empty containers.

The findings from the interviews show that the containers on the railway deck from dry ports to seaports are not always organised according to vessels' schedules. As a result, seaport personnel were forced to spend more time identifying the containers and pairing them with the right vessels, which may affect the schedule integrity of shipping lines. The disarrangement of containers on the rail decks happened because of the rush at the dry ports, coupled with unavailability of precise information sharing along the container seaport system. Efficient information sharing for planning container distribution among dry port stakeholders, in particular between dry ports and seaports, through an information communication system is suggested.

For empty container management, in addition to expanding the space of dry ports, location pooling between dry ports and inland terminals can be considered.

8.3.2.1 Information sharing for planning container distribution

Information sharing between players in the container seaport system assists in operational integration of container distribution between different players in the container seaport system. Monios and Wilmsmeier (2014) argued that it is the commercial nature of the maritime industry that leads to one stakeholder's information not always being available to another stakeholder due to the complexity along the chain and low quality of links. This

argument applies to Malaysian seaport systems as currently information on container distribution is not always accurate or received in a timely manner by seaports, as indicated in Chapter Six.

As indicated by the interview participant (FIP1) in the qualitative phase of the research, the information disintegration among key players in the seaport system resulted in on average one to two hours to relocate and rearrange the containers according to the vessel's schedule at seaports. This situation will lead to increased empty space in the container vessel and damage the reputation of the seaports among its clients. Information sharing between dry ports and seaports for container freight movements can enhance seaport performance by reducing the waiting time of vessels in seaports, subsequently reducing the vessel turnaround time and avoiding shipping lines from demurrage charges. The finding in Chapter Seven supports that information sharing has significant impact on seaport performance (refer to Table 7.16 in Chapter Seven).

There is a need to utilise information communication technology to coordinate information within the Malaysian seaport system. Currently, not all players in the Malaysian container seaport system are connected within a single information platform. Port Klang Authority (PKA) has developed its own electronic supply chain system called Port Klang Net (PKN). However, this network only connects PKA with other operators within the port, i.e. West Port and North Port (Eleventh Malaysian Plan 2016). This system is not connected to other key stakeholders along the supply chain, and cannot achieve an efficient information coordination process in the transport chain. Therefore, the players in the container transportation chain need to be connected with a single information exchange network to improve the efficacy of information flow and sharing.

Some countries in the world have introduced the Port Community System or similar to coordinate information along the seaport system. For example, Spain introduced the Port Community System (PCS) to manage information exchange and integration among the different actors including dry ports in container seaport systems, and it is an effective solution for container planning and management (Dotoli et al. 2010). The government in Malaysia should consider cooperating with seaports, dry ports and other stakeholders in the system to invest in such an information integration platform.

8.3.2.2 Location pooling between dry ports and inland terminals

Space for managing empty containers is another challenge for Malaysian dry ports. As indicated by some interview participants, there is a need for dry ports to expand for managing empty containers. However, not all dry ports have available space for expansion and development. For example, PBCT does not have additional space to accommodate empty containers either at present or in the future. Therefore it is difficult for PBCT to accommodate empty containers from Penang Port, Port Klang and southern Thailand. On the other hand, NIP has additional land for future development, implying that the dry port has capacity to accommodate future increased trade. Dry ports have to prepare to accommodate additional demands or requirements in the future. Location pooling between dry ports in Malaysia may be able to help dry ports overcome the space limitation for managing empty containers.

Location pooling is a space-sharing strategy between inland terminals. A terminal with ample space may allow the accommodation of overflow containers from closely located inland terminals. It is suggested that dry ports in Malaysia create network links with other types of intermodal terminal to establish cooperation in managing containers. For example, there is an inland clearance depot near to PBCT called Bukit Kayu Hitam Inland Clearance

Depot, which is located 44 kilometres from PBCT. It could be a suitable choice for location pooling and overcoming the space limitation at PBCT.

Additionally, there is a depot called Sungai Way Inland Clearance Depot, located within 50 kilometres of NIP, which could be utilised for location pooling. The location pooling strategy between dry ports and inland depots creates a new collaboration in freight distribution strategy and empty container management. A collaborative cooperation through location pooling among dry ports and container depots improves the effectiveness of the supply chain (Simatupang & Sridharan 2002). Hence, location pooling with inland depots to accommodate empty container in PBCT and NIP provides an alternative to deal with space restrictions at dry ports.

8.3.3 Competition

Competition with seaports is a challenge for Malaysian dry ports. The interview outcome showed that some seaport operators and shipping lines do not favour dry ports located adjacent to seaports because of competition, such as the case with SIP and PTP in the southern region of peninsular Malaysia. Many shipping lines rely on seaports to provide logistic services to manufacturers who send their containers directly to the seaports and, as a result, they have to compete with dry ports to cater to the local market. To cope with this challenge, strategies such as enhancing the capability of dry ports and cooperation between seaports and dry ports may provide a better solution for dry ports.

8.3.3.1 Enhancing the capability of dry ports

Dry ports need to improve their capability to facilitate container freight in the container seaport system by providing space for laden and empty containers and perform seaport functions in inland. Therefore, as suggested by the interviewee in Chapter Six, dry ports

need to meet operational requirements. The interviewee suggested three pre-requisites for Malaysian dry port operations, i.e. operational infrastructure, personnel requirements and capital infrastructure. Dry ports need to improve these fundamental requirements in order to perform as an extension of seaports. Without having sufficient fundamental requirements, dry ports are unable to be utilised by seaports or other clients.

A well-operated dry port enriches the confidence of the clients to use this terminal during their transaction (Woxenius et al. 2004). Additional space in PBCT, ICT and NIP and variety of services in SIP are urgently required to gain the trust of the clients. The users always have very high expectations of dry ports, especially with regard to variety and quality of the services to meet their expectations. A well-operated dry port will simultaneously attract more clients towards these intermodal terminals.

Dry ports providing value adding services not only benefit customers in inland regions but also enhance their competitiveness to compete with seaports (Haezendonck et al. 2014; Robles 2013). The strategy to enhance Malaysian dry ports' capability could be focused on the provision of value adding services because currently these are mostly absent in most of the dry ports, according to the interviewees. Malaysian dry ports need advanced facilities to provide value adding services to satisfy customers' needs. As evidence, Brazilian dry ports managed to reduce the competition between seaports, attract additional clients and revealed their capability in the transport chain after they diversified their activities and provided a range of value adding services to the clients (Robles 2013).

A reliable labour force used by dry ports is essential to execute operational procedures. Appropriate professional labour is recommended to overcome issues in container planning. However, this strategy can also be adopted by Malaysian dry ports to excel in the competition. Highly trained labour in dry ports reduces unnecessary mistakes and

operational defaults which would obviously reduce the delays and lead to smoothness in seaport operations. As evidence, research from FDT (2007) indicated that a professional workforce with the right level of capabilities is required to operate the dry port to reduce delays at seaports. Similarly, the involvement of professional manpower at PBCT may reduce the operational defects, attract additional clients from Thailand and improve the punctuality of containers' delivery to Penang Port.

8.3.3.2 Cooperation between seaports and dry ports

Collaboration between seaports and dry ports overcomes the competition between these terminals. Dry ports and seaports have to build a cooperative relationship between them for container freight distribution in the container seaport system. Although the quantitative research finding in Chapter Seven showed that cooperation with seaports is an influencing factor to Malaysian dry ports' operation, through extensive cooperation with seaports, dry ports may be able to increase their capacity to have significant impact on other areas of seaport competitiveness, as indicted in Chapter Seven.

In particular, the container seaport PTP is the main investor in SIP dry ports. Therefore, it is suggested that PTP should utilise the potential capacity of SIP through building a good cooperative relationship. Cooperation between seaport and dry port can be developed by increasing the multimodal facilities at the dry port. SIP currently has a low frequency of rail freight services which creates difficulties for shipment. In the Netherlands for example, the development of cooperation between seaport and dry port have been utilised to develop multimodal facilities in the dry ports and improve the freight movement to and from dry ports (Ecorys 2011). Similarly, the investment from PTP can be used to develop rail freight transportation to and from SIP. This might reduce the complications associated with long shipments and increase the demand of this dry port among the other key users.

SIP and PTP could follow the cooperation strategy that has been implemented in China. Seaports and dry ports in this region have been cooperating to develop logistic information, infrastructure construction, consulting, capital investment, personnel training and technology development (Beresford et al. 2012). Through this cooperation, the Xi' An dry port has managed to develop a better information system and has improved integration between the different management departments of transport, customs and e-commerce (Feng et al. 2013).

In addition to seaports, Malaysian dry ports face competition from shipping lines, resulting from the intention of shipping lines to dominate the hinterland market (Rodrigue et al. 2010). However, it is very complicated for a shipping line to dominate land-side transportation and ocean transportation simultaneously because of significant differences in cost, asset utilisation and responsiveness (Haralambides & Acciaro 2010). Therefore shipping lines need to incorporate with dry ports to reduce the disadvantages of sole domination in both foreland and hinterland. The cooperation between seaports and dry ports could initiate a mutualistic-relationship between seaport and dry port and consequently reduce the competition between them, accelerate the awareness of the importance of dry ports in the container seaport system as well as increase the recognition of dry ports' function in Malaysian container freight transportation.

8.3.4. Location

The less strategic location of a dry port may cause the key players in the container seaport system to be unable to utilise the dry port's facilities during container transportation from seaport to hinterland and vice versa. The empirical result in Chapter Seven showed that the location of dry ports not only influences dry port operations but also seaport performance. In Malaysia three dry ports, namely PBCT, ICT and NIP, are situated at a very strategic

location. However, SIP is located away from manufacturers and this has caused a very low record of container volume to seaports despite the fact that it is the largest dry port in the nation. The flash floods in Segamat district, close to SIP, have resulted in a significant loss in transport infrastructure and facilities, approximately USD263 million every year since 2007 (Sulaiman et al. 2012). This annual natural disaster significantly affects SIP's operation, especially in freight transportation to and from the dry port. To overcome the challenges faced by SIP, the following strategies, including utilising dry ports in the container transportation chain, cooperation with other dry ports and location shifting, are recommended.

8.3.4.1 Increase SIP's attractiveness by enhancing multimodal transportation and providing different services

SIP dry port is located away from the manufacturing area and as a result it is underutilised owing to insufficient cargo sources. Given this challenge, SIP needs to be optimistic and develop its own attractiveness by providing services that are different from those of others, such as using Radio Frequency Identification (RFID), technical advice for customised services, packaging services based on local market taste and language as well as advanced value adding services, as indicated by Andersson & Roso (2016), to garner more users to use the dry port. The location of dry ports equipped with sufficient multimodal support manages to reduce freighting cost, reduce the pressure on road transportation, enhance rail freight and consequently overcome the location issue of dry ports. The development of even multimodal transportation may attract users from the east coast, southern region and also from the Singapore market. Of importance, the availability of international freight corridors, including IMS-GT and the southern regional freight corridor, provide an opportunity for the development of SIP dry port especially in terms of transportation facilities, economic development, standardisation of customs procedures for crossborder

freight transportation and development of transport infrastructure (Humphries 2004; Tenth Malaysia Plan 2011).

8.3.4.2 Collaboration with other dry ports

Collaborating with other dry ports and other intermodal terminals may be able to increase the utilisation of dry ports that have a disadvantageous location. Collaboration between dry ports increases the connectivity to move container freights to and from seaports. The above view was expressed by an official from SIP dry port during the interview session. The juxtaposition of SIP and NIP needs to be utilised to overcome the underutilisation issue in SIP. These dry ports are located close to each other. Therefore, cooperation between these dry ports to increase space utilisation in SIP would reduce the container turnaround time and empty container movement on land which cause traffic congestion and pollution. Moreover, cooperation between this seaport and dry port would expand the seaport network in inland areas, especially in the east coast region. Currently, NIP has no space capacity for empty containers. On the other hand, SIP is the largest dry port with large space availability. If NIP were to share the space at SIP, this cooperation would lead to SIP being fully utilised and the space issue in NIP can be overcome.

8.3.4.3 Location shifting

Referring to the experience of Swedish dry port Amal, addressed in Chapter Two, this dry port was shifted to a new location owing to the fact that it was not able to overcome the challenges of accessibility, connectivity and physical infrastructure (Woxenius & Bergqvist 2010). This research suggests that SIP dry port may be shifted to another location, Gemas, if the challenges SIP has faced cannot be overcome. Gemas dry port is proposed because it is close to Port Klang and located at a rail link junction connecting

Padang Besar in the north, peninsular-Singapore in the south and the east coast of Malaysia (see Figure 8.4).

As shown in Figure 8.4, Gemas dry port has the potential to provide a transport link between east and west coast Malaysia and generate additional containers from the east coast freight corridor to Port Klang and PTP. This new transposition of SIP to Gemas would be expected to boost trade from the South China Sea and the east coast of peninsular Malaysia and, most importantly, it would be away from the zone of flash floods, making it far more safe than in its current location. Shifting SIP's location to Gemas dry port may provide a positive impact on the remaining four components in seaport competitiveness including increasing service variations for seaports, improving seaport-hinterland proximity, increasing seaport trade volume and enhancing seaport capacities which are not currently impacted by the location of dry ports.

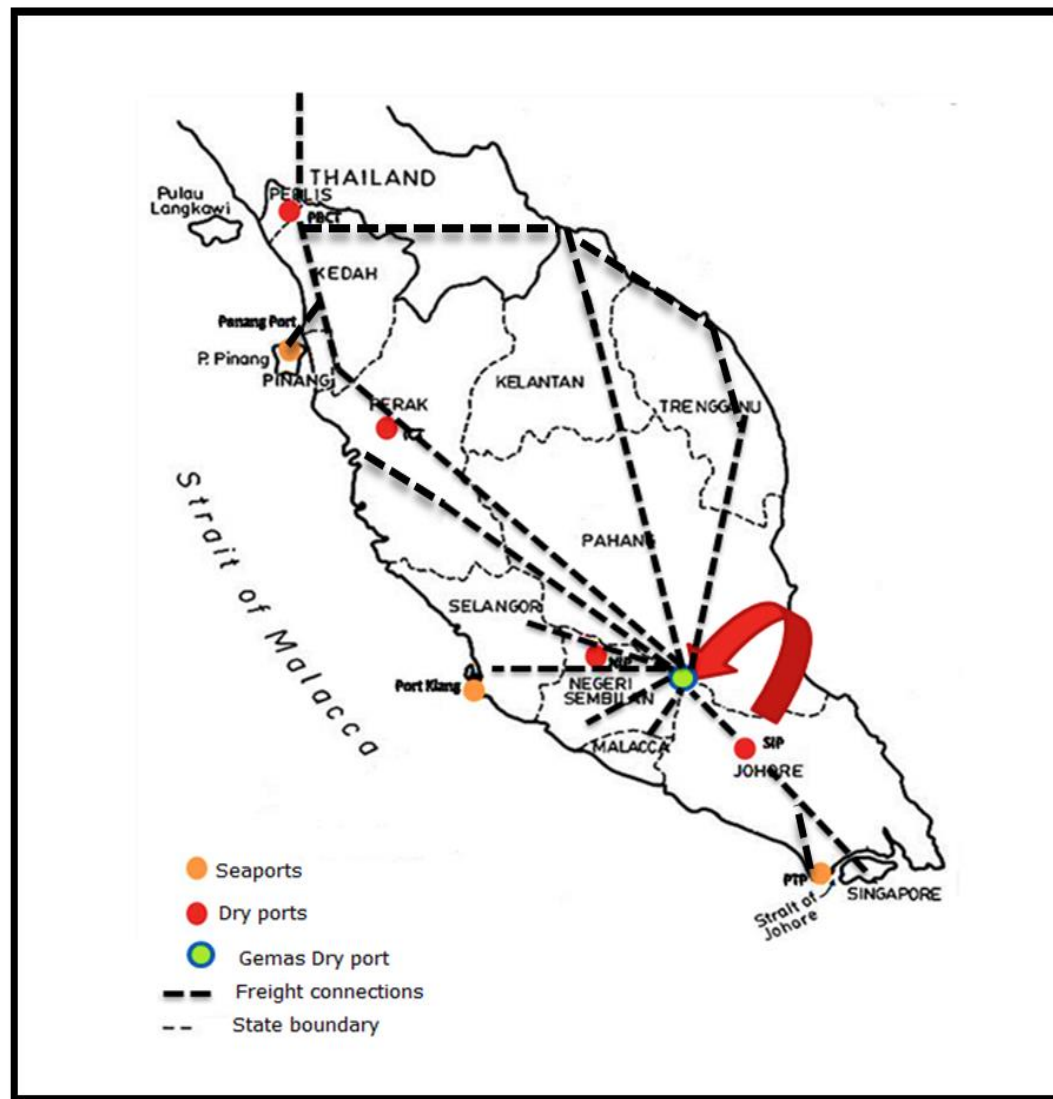


Figure 8.4: Transposition of SIP to Gemas dry port
Source: Adapted from Chen et al. (2015)

8.3.5. Community

Malaysian dry ports' operations have resulted in communities' concerns about some issues, including noise and air pollution generated by the freight vehicles and the operation of handling equipment, and traffic congestion in some regional areas. In addition, the interview outcome also identified that there is a lack of awareness and understanding of dry ports throughout the community. In addition is the increasing public concern about barter trade, as dry ports have an opportunity to manage barter trade.

8.3.5.1 Freight transportation development

Pollution and traffic congestion in Port Klang, NIP and PBCT are some of the crucial challenges caused by dry ports. In order to ensure the mission of Malaysian dry ports are parallel with the general scenario of dry ports, an even development of freight transportation is urgently required to produce a significant effect on reducing pollution and overcoming traffic congestion. The development of rail freight transportation along with wide roads will decrease the domination of road freight in ICT and NIP, thereby reducing the pressure on roads, reducing traffic congestion and pollution, and providing more space for frequent road repair and upgrading processes. This indicates that a single solution to freight transportation manages to overcome other substantial negative implications which affect dry port operations.

The availability of various opportunities such inter/intra freight corridors, the Logistics and Trade Facilitation Master Plan and others, as indicated in Figure 8.2, may provide the impetus for policy makers to plan and develop freight transportation development in this region.

8.3.5.2 Dry port marketing

The exposure of Malaysian dry ports to the players in the container seaport system and the community is not significant according to the interview findings, in particular, SIP. This is because SIP has a disadvantageous strategic location away from manufacturers. Currently all four dry ports have no comprehensive marketing strategy due to the limited man power, not sufficient fund allocation especially for marketing purposes and have limited exposure especially on dry port marketing. Therefore, it is suggested that SIP dry port needs to undertake a marketing strategy to increase its exposure to the relevant stakeholders.

Basically, the marketing strategy will be the appropriate strategy to overcome underutilised capacity, improve operational efficiency and increase the business revenue (Cahoon 2007). Therefore, four major components as indicated by Cahoon (2007) including promotion, community liaison, trade and business development and customer relationship management need to be enforced in Malaysian dry ports to increase the awareness of this terminal among the users. Furthermore, to undertake the marketing strategy, criteria such as customer care, service customisation and diversification are important components that need to be prioritised at the dry port.

8.3.5.3 Safety and security

During the interview session in the qualitative phase of this research, a respondent (FIP1) mentioned that cargo smuggling is one of the main concerns at the Malaysia-Thailand border. Therefore, the border dry port should perform strict immigration and quarantine examinations. Currently, the concerns from the participants were about the human resources to manage safety and security procedures in the dry ports. However, they did not mention the requirement of safety equipment or devices for security screening, especially at the borders.

For example, the application of RFID at the borders may improve the confidence of international shippers to meet the expectation of domestic customers in Malaysia. According to Masek et al. (2016), the application of RFID at the borders may reduce some redundancy during cross border transactions and simultaneously increase the reliability of services by reducing the transit time, providing a high frequency and providing convenience for the customers to track the condition and location of the cargo. Based on the expected outcome from RFID, the application of this device needs to be implemented in all dry ports to ensure the reliability and the safety of the cargo.

The impact from RFID will result in simplification of technological activities during border-crossing transactions. According to Fabian (2013) the nature of this technology, which is flexible, brings cost savings and benefits for carriers and their customers. Therefore, considering the implementation of RFID technology as a centralised centre of information sharing between international and domestic players in the container seaport system would be a practical idea.

8.3.5.4 Involvement of dry ports in the barter trade

Barter trade generally refers to trade activities between opposite shores of the Straits of Malacca (see Figure 8.5). Barter trade recorded 84,000 vessels in Malacca straits from 2004 until 2010, contributing approximately 18–24% of the total trade in Malaysia (Dollah & Mohammad 2010). In addition to Port Klang, Penang Port and PTP, Malaysian minor ports such as Port Dickson, Muar seaport and federal seaports such as Malacca port are involved in barter trade between Thailand, the Philippines and Indonesia (Rusli 2012). To enhance the traditional inter-Asian trade, the procedure of barter trade is not governed with rules as strict as those at seaports (Shahryari & Ibrahim 2009). According to one interview participant (FIP5), barter trade becomes an advantage to the traders who undertake some illegal activities. The participant also added that the inspection of the cargo for barter trade is not compulsory unless required. There is no immigration clearance for the barter trade and it has become a major concern to the general public due to the increased illegal immigrant and smuggling cases.

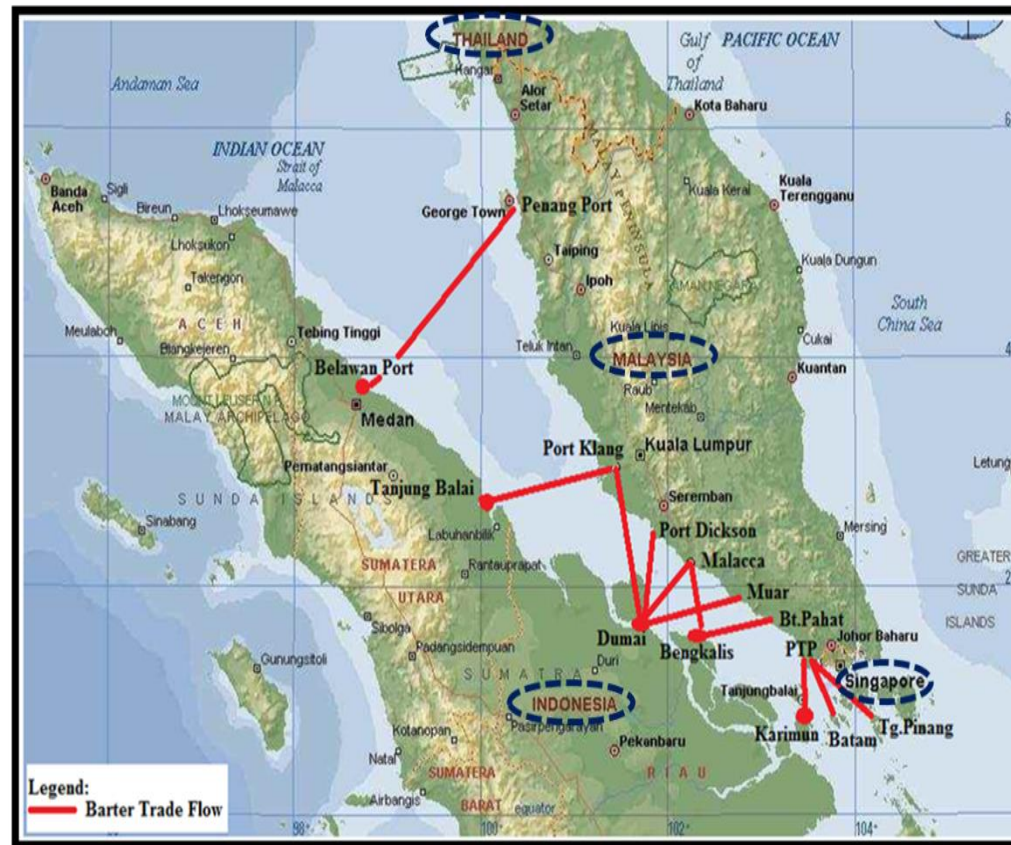


Figure 8.5: Barter trade flow in Malaysia
Source: Adapted from Evers and Gerke (2006)

Owing to the social concern of security, the involvement of dry ports is suggested for the barter trade. Malaysian dry ports could be included in barter trade, specialising in handling the import and export of cargo such as grain, coal, light vehicles, sugar and other goods from Indonesia, Thailand and the Philippines. The involvement of customs clearance for barter trade at dry ports improves security assessment during the transactions. Currently, dry ports operate under the Ministry of Transportation and provide administrative functions in the daily operations. Therefore, the involvement of dry ports in the barter trade system would automatically fall under the responsibility of the Ministry of Transportation and it would strengthen the rules and regulations for barter trade operations. As evidence, illegal logging and smuggling activities originating from barter trade transactions has been reduced by the strict documentation verification procedures of the

customs agencies in Singapore (Keong et al. 2012). Hence, all the cargo from barter trade would be transported in containers to dry ports for customs clearance.

Currently all barter cargo are imported and exported by means of pallets with non-standardised packaging (FIP1). With the involvement of dry ports, all containers would be transported to dry ports for clearance procedures and value adding. Customs clearance, police inspections and security screening would be able to reduce all the negative consequences that arise from current barter trade. Moreover, the value adding process at dry ports manages to increase the value of the cargo in the consumer market. This ensures that the involvement of dry ports in barter trade improves the safety and security systems in this traditional trade as well as improves the competitiveness of the cargo price in the consumer market.

Therefore, incorporating dry ports in barter trade may overcome the issue of illegal immigrants and smuggling as well as increase inter-Asian trade and create momentum in the existing cooperation between the regions such as IMS-GT and IMT-GT. Malaysian dry ports can benefit from this strategy, increasing their business, and Malaysian seaports can also benefit from reducing activities in this regard and focus on international cargo. Table 8.1 summarises the challenges faced by dry ports and strategies to overcome those challenges according to the discussion in previous sections.

Table 8.1: Strategies for dry ports development

Challenges	Strategies
Transportation infrastructure and operation <ul style="list-style-type: none"> • Insufficient rail services • Imbalanced rail and road transport modal split • Limited wide road width 	<ul style="list-style-type: none"> • Introducing double track rails • Providing options for east coast Malaysian freight transportation • Providing haulier service through vertical integration • Increasing modal split by increasing rail transport • Milk-run logistic • Utilise inter/intra- regions freight corridors for infrastructure development
Container planning <ul style="list-style-type: none"> • Unorganised containers on rail deck to seaports • Limited space for managing empty containers 	<ul style="list-style-type: none"> • Information sharing for planning container distribution • Location pooling between dry ports and inland terminals
Competition <ul style="list-style-type: none"> • Competition with seaports and other players in the container seaport system 	<ul style="list-style-type: none"> • Enhancing the capability of dry ports • Cooperation between seaports and dry ports
Location <ul style="list-style-type: none"> • Location of dry ports away from manufacturing area • Location of dry ports in less strategic zone 	<ul style="list-style-type: none"> • Increase SIP's attractiveness by enhancing multimodal transportation and providing different services • Collaboration with other dry ports • Location shifting
Community <ul style="list-style-type: none"> • Noise, air and congestion • Smuggling issue • Social concern from barter trade • Lack of awareness about dry ports 	<ul style="list-style-type: none"> • Freight transportation development • Safety and security (RFID) • Involving dry ports in the barter trade • Dry port marketing

8.4 Summary

This chapter discussed the results of the qualitative and quantitative outcomes to answer the SRQ3. There are two opportunities for dry ports that have been identified in this research, namely accessibility to the international transportation network and the government's international and national economic development plans. The opportunities of dry ports for future development reduce the challenges faced from various perspectives and increase the strength of these intermodal terminals in the container seaport system. The utilisation of dry ports' opportunities for future development increases the possibilities to enhance seaport competitiveness in the container seaport system.

Strategies such as the introduction of double track railways, providing options for east coast Malaysian freight transportation, increasing modal split by increasing rail transport, providing haulier service through vertical integration, milk-run logistic and utilisation of intra- and inter-regional economic development are also suggested to overcome the challenges from the perspective of transportation and operation.

Secondly, information sharing for planning container distribution and location pooling between dry ports and inland terminals have been suggested to overcome the disintegration in container planning. Then, strategies such as enhancing the capability of dry ports and cooperation between seaports and dry ports are recommended to overcome the competition.

Strategies such as increasing SIP's attractiveness by enhancing multimodal transportation and providing different services, collaboration with other dry ports and location shifting are some of strategies that have been recommended to overcome challenges from the location perspective. Finally, to reduce the negative impact to the community, even development of freight transportation, implementation of RFID technology in dry port operation, dry port marketing and involving dry ports in barter trade are some of the proposed strategies.

The next chapter will conclude this research. It will outline the findings, contributions and limitations, and recommend future research directions.

CHAPTER NINE

CONCLUSION

9.1 Introduction

This empirical research investigates the development of dry ports in Malaysia and their impact on the competitiveness of container seaports. This thesis conducted an extensive review of the literature in the field of dry ports to address their roles, functions and challenges, and identified the influencing factors of operations and their impact on container seaport competitiveness (chapters 2 and 3 respectively). It identified the Malaysian container seaport system consisting of freight corridors, container seaports, dry ports and transport modes (Chapter Four). This thesis adopted a mixed method research methodology, consisting of a qualitative phase comprising face-to-face interviews followed by a quantitative phase of online questionnaire surveys, to collect primary data from Malaysian key dry port stakeholders. Data were analysed using grounded theory and the EFA method (Chapters Five, Six and Seven respectively). With the findings from qualitative and quantitative phases, this thesis recommended strategies to improve Malaysian dry port operations and utilise opportunities so as to enhance container seaport competitiveness (Chapter Eight).

This concluding chapter summarises the research findings from a review of the literature and the empirical research. Subsequently, it addresses the contribution and limitations of this research. Finally, directions for further research are recommended.

9.2 Findings from the literature review

The concepts of seaport regionalisation and seaport lifecycle provide the background to the emergence of dry ports in the container seaport system. Dry ports, each being a node of transport networks, assist in distributing containers and thus help seaports to extend their hinterlands. Additional capacity from dry ports may extend the seaport's lifecycle at the

maturity stage. As a result, dry ports have emerged as one of the major components in the container seaport system in addition to freight corridors, container seaports and multimodal transportation.

The findings of the literature review show that there are different types of dry ports globally which are mainly categorised based on distance and location. From the distance perspective, dry ports are categorised as close dry ports, mid-range dry ports and distant dry ports. From the location perspective, dry ports are classified as seaport-based dry ports, city-based dry ports and border-based dry ports. They play four major roles, as an extended gateway for container seaports, an integrator for intermodal transport systems, a freight platform and promoting regional economy development. Dry ports' main functionalities are focused on transportation, logistic, value adding services and administration.

Challenges faced by dry ports vary among countries. In general, the main issues were related to transport infrastructure and operations, information sharing, competition and location. Other issues included limited connectivity to and from dry ports, low accessibility of freight transportation, difficulties for short distance container delivery, imbalance in modal split and congestion in dry ports which are the main challenges faced by dry ports, especially those arising from transport infrastructure and operations. Lack of information integration between the players in the container seaport system is the key issue in the information sharing. Dry ports also face some competition between inland terminals and seaports. From the location perspective, dry ports which are located away from manufacturers and transport connectivity faced underutilisation issues and reduced attractiveness to the players in the container seaport system. In addition, expensive labour costs, depending on manual procedures for cargo inspections and lack of involvement of public sectors are some of the additional challenges faced by dry ports.

Hinterland condition, service features, government policy, capacity and information sharing were the main influencing factors of dry port operations which were discussed in Chapter Three. Moreover, the operation of dry ports appears to have a number of impacts on seaport competitiveness. Those impacts initiated by dry ports were enhancement in seaport performance, seaport capacity, improvement in seaport-hinterland proximity, increase in service variations for seaports and seaport trade volume.

Chapter Four overviewed the Malaysian container seaport system consisting of four main components, namely seaports, dry ports, freight corridors and multimodal transportation. The chapter revealed that there are three main container seaports in the Malaysian container seaport system: Port Klang, Penang Port and Port of Tanjung Pelepas (PTP). These container seaports are supported by four main dry ports. PBCT, a border-based dry port, supports Penang Port and Port Klang; ICT, a city-based dry port, is connected to Port Klang, Penang Port and PTP; NIP, a city-based dry port, supports Port Klang and PTP, and SIP is a border-based dry port assisting Port Klang and PTP.

Malaysian dry ports and seaports are connected with road and rail networks. However, NIP is the only dry port in the nation which does not connect with rail networks. In addition, the Malaysia-Thailand Landbridge (MTL) and the Singapore-Kunming Rail Link provide rail freight connections to Malaysian container seaports between Singapore-Malaysia-Thailand. The findings in this chapter also revealed that all Malaysian dry ports are located within respective intra-regional freight corridors including northern, central, southern and east coast freight corridors. Inter-regional freight corridors include the Indonesia-Malaysia-Singapore Growth Triangle and the Indonesia-Malaysia-Thailand Growth Triangle. The findings in this chapter emphasised how dry ports located in the main freight corridors support container seaports for container distribution through multimodal transportation to and from the hinterland.

9.3 Summary of the empirical findings

In the qualitative phase of this research, Malaysian dry ports' role, objectives, functions and benefits were explored. In addition, requirements for Malaysian dry port operations and challenges dry ports are facing were investigated.

The empirical findings show that Malaysian dry ports play three major roles in the container seaport system. Firstly, they are an extended seaport in inland regions that facilitate container distribution by providing space for laden and empty containers and seaport activities inland to provide time and cost advantages to clients and ensure the continuity of container volume to seaports. Secondly, Malaysian dry ports play a role as a regional intermodal node in order to provide transshipment activities in inland regions and to balance regional economic development in peninsular Malaysia. Finally, dry ports are an interface terminal between road and rail transportation to integrate the freight movement between seaports and manufacturers and consumption points in the inland areas. The roles of Malaysian dry ports are not different to the four roles discovered from the literature review, which are an extended gateway for container seaports, an integrator for intermodal transport systems, a freight platform and promoting regional economy.

Malaysian dry ports aim at accelerating national and international trade, activating intermodalism in the country, improving seaport competitiveness, enhancing regional economy, and establishing national seaport policy. In terms of functionalities, Malaysian dry ports perform transport functions, logistic function, value adding function and administration function, which are similar to other dry ports in different nations.

Key stakeholders of Malaysian dry ports stated that Malaysian dry ports bring benefits for seaports and stakeholders in managing cargo transported to and from seaports. The benefits are reducing waiting times at seaports, providing an effective clearance system,

decreasing freight costs, facilitating cross border transactions and reducing empty container movements. Key stakeholders interviewed in this research also expressed that Malaysian dry ports should have sufficient operational and capital infrastructure, and have competent personnel for operations to enhance performance.

Despite Malaysian dry ports having strengths such as location, involvement of PPP, and adequate transport connectivity through road and rail, there are challenges faced by them, including insufficient rail infrastructure and services, operational inefficiency, space constraints for managing empty containers and containers on trains to seaports not being organised according to vessel schedules, competition with seaports, disadvantageous location of one dry port (SIP), and community concerns about noise and air pollution generated by the freight vehicles and the operation of handling equipment, and traffic congestion in some regional areas.

In the quantitative phase of this research, exploratory factor analysis (EFA) was employed to identify the factors that influence the operation of Malaysian dry ports and to investigate the impact of dry ports on seaport competitiveness. In the literature review chapter, five main factors influencing dry port operations were identified, consisting of information sharing, service features, capacity, government policy, and hinterland condition. The EFA results of this empirical research added two factors, i.e. location and administration, to the five factors.

As indicated in the qualitative phase, one of the Malaysian dry ports' objectives is to enhance seaport competitiveness. The EFA results show that survey respondents considered Malaysian dry ports can enhance seaports' competitiveness especially through enhancing seaport-hinterland proximity, enhancing seaport capacity, increasing the variety of seaport services, improving seaport performance, and accelerating the volume of

container trade. However, the result of regression analysis investigating how the influencing factors affect seaport competitiveness indicate that Malaysian dry ports significantly contribute to enhancing seaport performance, improving the variation in seaport services and improving seaport-hinterland proximity.

Looking to the future, the external environment including international and national prospects has provided Malaysian dry ports with business and development opportunities. Opportunities include accessibility to international transportation networks and the availability of international and national economic development plans. These will stimulate freight volume at national and international levels. As Malaysian dry ports are facing some challenges, this research recommended strategies to tackle the challenges in order to take advantage of the opportunities indicated.

Strategies related to improving transport infrastructure and operation, enhancing container planning, reducing competition, overcoming disadvantageous location and caring for community concerns were initiated. These include introducing double track rails, providing options for east coast Malaysian freight transportation, providing haulier service through vertical integration, increasing modal split by increasing rail transport, implementing milk-run logistic, and utilising inter/intra-regions freight corridors for infrastructure development to overcome the challenges in transport infrastructure and operations. In order to overcome unorganised containers on rail deck to seaports and space limitation to handle empty containers, information sharing for planning container distribution and location pooling between dry ports and inland terminals have been proposed. Furthermore, the strategies of enhancing dry ports' capability and increasing cooperation between seaports and dry ports were recommended to overcome the competition from seaports and inland terminals.

As SIP is the only Malaysian dry port having a location issue, this research suggested increasing SIP's attractiveness by enhancing its multimodal transportation network by extending rail to the dry port, providing different services, and collaboration with other dry ports. Alternatively, location shifting could be considered. When dealing with the community concerns, it is suggested that balancing the transport mode by increasing rail can deal with noise and pollution issues, and the application of RFID can improve the safety and security of cargo at dry ports. To increase the awareness of dry ports in the wider Malaysian port community, dry port marketing can be adopted. Finally, involving dry ports in the barter trade increases dry ports' trade volume and reduces the community concern about smuggling and other security issues.

9.4 Contributions of the research

This research has made several academic and managerial contributions. From the academic perspective, this thesis contributes to the existing literature of dry port research through an empirical study on Malaysian dry ports, which has not been seen in the academic literature. It explicitly revealed the roles, functionalities and objectives of dry ports in Malaysia and the influential factors of dry port operations.

Secondly, the previous research related to Malaysia's seaport systems was mainly focused on Malaysian container seaports' productivity (Kasypi & Shah 2006), privatisation (Tull & Reveley 2002) and performance (Valentine & Gray 2001). In this research, the scope of container seaport research has been extended to hinterland component dry ports to investigate the relationship between dry ports and container seaport competitiveness. As there is very limited empirical research on the impact of dry ports on seaport competitiveness, this empirical research adopting a quantitative method to investigate how

dry ports impacted container seaports in the Malaysian context contributed to the literature in this regard.

Thirdly, this research contributes to the methodological development of dry port studies. The dry port studies in the literature mainly adopted a qualitative method, such as Andersson and Roso (2016); Ng et al. (2013); Bergqvist (2013); Roso (2008) and Beresford et al. (2012). This research employed an exploratory sequential design of mixed methods methodology integrating qualitative and quantitative phases in a single research, covering dry ports and seaports. A mixed methods approach has been used as a research methodology since 1980, especially in health sciences, sociologies and education (Chen 2012; Creswell & Clark 2011). In contrast, the indication of mixed methods application is not clear in maritime-related research (Woo et al. 2013). Therefore, this research set an example in this regard.

Despite the usage of mixed methods in social science being a growing trend, there is insufficient guidance or frameworks for qualitative and quantitative data integration or mixing in many research studies (Bryman 2007). Although many research studies provide allegories to infuse qualitative and quantitative findings (Bazeley 2009; Bazeley & Kemp 2011), the absence of significant examples on data integration and lack of standard examples of qualitative and quantitative data integration restrict the utilisation of mixed methods research. Hence, this research contributes by demonstrating a way of mixing the qualitative and quantitative data. The mixing has been created before the interpretation stage and it shows that the exploratory mixed methods design has been implemented throughout the research process. The data mixing in this exploratory sequential design does not occur during the end of the study, it started during the qualitative and quantitative research questions' development at the early stage of the study. Secondly, the combination

of qualitative and quantitative based research questions in a single study eases the mixing process at the interpretation stage. Thirdly, the mixing has been conducted while selecting the participants for the quantitative follow-up analysis based on the qualitative results. Fourthly, the results from phase one have been used as a tool to develop the survey instrument for data collection at the quantitative phase.

Innovation design in mixed methods should be included in designing mixed methods research (Tashakkori & Teddlie 2003; Creswell & Clark 2011). Therefore, the innovation in designing mixed methods research in this research has been done by utilising the strength of both approaches to address the primary research question thoroughly and ensure the outputs of this research are valid for generalisability.

From a managerial perspective, this research has made four contributions to Malaysian policy makers and dry ports' stakeholders. Firstly, it reveals all of the components in the Malaysian container seaport system within which dry ports are one component. This research therefore will contribute to the increase in the awareness of dry ports to the players within the seaport system and the general community, which appears to be less recognised from the findings in this research. It will help to promote dry ports for better utilisation to facilitate the container transportation to and from seaports.

Secondly, this research provides relevant information on the Malaysian dry port operations, factors that influence their operations and the impact on seaport competitiveness to dry port operators to develop strategies for enhancing dry port operations to assist container seaports and their clients.

Thirdly, this empirical research helps policy makers to gain information on the challenges faced by Malaysian dry ports. The strategies initiated in this research can also help the

policy makers to develop policy or take actions to improve dry port operation in Malaysia, which will help to enhance seaport competitiveness.

Fourthly, the findings of this research provide a reference to the policy makers to incorporate dry ports in their seaport development strategy to improve the efficiency and effectiveness of container freight distribution.

9.5 Limitations of the research

Despite mixed methods research providing significant benefits, it requires more work, extensive resources and considerable time to apply this design in this research (Creswell & Clark 2011). Semi-structured face-to-face interviews have been conducted to gain more comprehensive and complex data. However, most of the respondents were reluctant to expose some important and additional data which they considered confidential and a wider scope might have been opened in this research if they had revealed this information. The qualitative phase may have a potential bias executed by the researcher during the data collection and analysis procedures. To overcome this bias, a distance has been maintained from the interviewees to prevent any beliefs or judgements towards them.

A list-based stratified sampling strategy has been applied in the second phase. The ability to control the sampling was important as lack of speed in internet coverage, multiple responses and false identity would have had an impact on the quality of the research outcome. Therefore, a list-based stratified sampling was developed to control this situation. The aim of this sampling was to generate more potential participants to be involved at this phase. Sampling control at this stage became important because it was difficult to locate appropriate samples as the aim of the research involved two major specifications: influencing factors of dry port operations and their impact on container

seaports' competitiveness. Participants involved in this phase were stakeholders who keenly used dry ports and this required precise inspection to select potential respondents. Moreover, this sampling strategy also needed to generate more respondents which was important for generalising the output to the population (Wilkinson & Thornton 1999).

Limited numbers of professional personnel at dry ports to provide strategic insights reduced their participation in the quantitative phase. Therefore, in relation to generalisability, a competent survey instrument was developed for the quantitative phase, based on the outcomes from face-to-face interviews and also from the extant literature pertaining to dry port operations and container seaport competitiveness. A combination of these steps assisted in enhancing the extensiveness of the scope and increasing the generalisability of this research. The mixed methods strategy enhanced the reliability and validity of the outcome as the strength of one phase minimised the weakness of the other.

9.6 Directions for future research

During the qualitative phase, the participants were reluctant to reveal some of the confidential information, especially on the challenges that dry ports faced in the container seaport system. Therefore, further research to investigate those issues needs to be conducted to provide significant improvement to the operational efficiency of Malaysian dry ports. A focus group interview approach is ideal to explore the complexity about a topic based on the knowledge and applicability of the participants (Richardson & Rabiee 2001). This approach can be conducted to gain interactive information on participants' perceptions, opinions and beliefs towards the challenges faced by the dry ports in the container seaport system.

Secondly, the nature of this thesis is based on well-designed sequential exploratory research and, for future investigation, the outcome from EFA can be further analysed with

confirmatory factor analysis (CFA) for cross validation between the seven influencing factors of dry port operations and the five factors regarding the impact of dry ports on seaport competitiveness. Moreover, other findings from the qualitative phase, especially on the roles, functions, challenges and opportunities of dry port operations, can be further validated by EFA and CFA.

Thirdly, this research has identified the influencing factors of Malaysian dry port operations. Further research can be focused on dry port performance such as developing the measures for evaluating Malaysian dry port performance. Similar to this research, sequential exploratory mixed methods research can be conducted to gather the most important variables to measure dry port performance in the first phase and validate those findings in the second phase. Hence, benchmarking can be developed to conduct meaningful comparisons among dry ports in Malaysia and provide insights into the differences to lay a base for improvements in Malaysian dry ports' performance.

Fourthly, this research validated the impact of dry ports on seaport competitiveness. Further research may be focused on the interdependent relationship between dry ports and seaports, e.g. how seaports collaborate with dry ports to enhance the performance of container seaport systems.

Finally, a comparative regional study on dry ports can be conducted between Malaysia and other regions from Southeast Asia (SEA). The method used in this research and its findings can be generalised to conduct a dry port study in any of the SEA countries, especially Thailand, Vietnam, Indonesia, Myanmar, Laos and others.

Overall, this thesis makes a contribution to the discussion about dry ports and in particular how government in Malaysia can propose strategies for dry development to improve dry

port operations in container seaport system and provide significant impact on container seaport competitiveness.

REFERENCES

- Abdul, M., Ibrahim, Y., & Hun, G. M. 2008, 'Keretapi tanah melayu bhd', *Asian Journal of Case Research* vol. 1, no. 2, pp. 163-182.
- Aberbach, J. D. & Rockman, B. A. 2002, 'Conducting and coding elite interviews', *Political Science & Politics*, vol. 35, no. 4, pp. 673-676.
- Acciaro, M. & McKinnon, A. 2013, 'Efficient hinterland transport infrastructure and services for large container ports', in *International Transport Forum European Conference of Ministers of Transport; Port investment and container shipping markets roundtable*, The Kühne Logistics University (KLU), Hamburg, Germany, pp. 18-25.
- Advani, M., Srirama, B. & Pathan, S. 2005, 'Optimization of transport routes using GIS technique e case study of Bhavnagar state transport depot', *Proceedings of the the ESRI National Conference*, December 1st and 2nd, 2005, Noida, India.
- Ahamed, Y. 2010, 'Final report of feasibility study of dry ports', in *Report for African trade Policy Centre (ATPC)*, United Nation, Economic Commission for Africa, Abu Dhabi, pp. 379-416.
- Allan, B. 2006, 'Integrating quantitative and qualitative research: how is it done?', *Journal of Qualitative Research* vol. 6, no. 1, pp. 97-113.
- Allen, J. 2007, 'Good practice guide for urban freight transport', in *Transport Research and Innovation.*, University of Westminster, Netherlands, pp. 45-82.
- Alpahliner 2015, 'The world's top 30 container ports', https://www.porttechnology.org/news/the_worlds_top_30_container_ports accessed 5th November 2015.
- Amos, P. 2009, 'Freight transport for development toolkit ', in *Rail freight development*, Transport division, Energy, Transport and Water Department, The World Bank, The international bank for reconstruction and development, Washington, pp. 38-48.
- Andersson, D. & Roso, V. 2016, *Developing dry ports through the use of value-added services*, Springer International Publishing, Switzerland.
- Annuar, M. 1994, 'The Brunei Darulsalam-Indonesia-Malaysia-The Philippines East ASEAN Growth Area (BIMP-EAGA): Problems, opportunities and prospects', *Proceedings of the Fourth Southeast Asia Roundtable on Economic Development - Growth Triangles in Southeast Asia: Strategy for Development*, 27-28 June, Kuala Lumpur.
- Anor, N., Ahmad, Z., Abdullah, J. & Hafizah, R. N. 2012, 'Road network system in Port Klang, Malaysia and Impacts to travel patterns', *Journal of Procedia-Social and Behavioral Sciences* vol. 35, pp. 629-639.

- Arvis, J. F., Mustara, M. A., Ojala, L., Shepperd, L. & Saslavsky, D. 2010, 'Connecting to compete-trade logistics in global economy report', in *The logistics performance index and its indicator*, World Bank and Turku School of Economics, Finland, Washington D.C., pp. 53-65.
- ASEAN 2011, 'Association of Southeast Asian Nation; Singapore-Kunming rail link project to sync with master plan on ASEAN connectivity', <http://www.asean.org/news/asean-secretariat-news/item/singapore-kunming-rail-link-project-to-sync-with-master-plan-on-asean-connectivity>, accessed 17th September 2014.
- ASIRT 2015, 'Association for safe international road travel', <http://www.asirt.org/portals/0/Reports/Malaysia.PDF>, accessed 5th May 2015.
- Australian Government 2007, 'The national statement on ethical conduct in human research', in *National statement, national health and medical research council*, Canberra.
- Aversa, R., Botter, R. C., Haralambides, H. & Yoshizaki, H. T. 2005, 'A mixed integer programming model on the location of a hub port in the east coast of South America', *Journal of Maritime Economics & Logistics*, vol. 7, no. 1, pp. 1-18.
- Ayiro, L. 2012, *Functional approach to educational research methods and statistics: Qualitative, quantitative, and mixed methods approaches*, 2nd edn, Edwin Mellen Press, New York.
- Ballis, A. & Golias, J. 2002, 'Comparative evaluation of existing and innovative rail-road freight transport terminals', *Journal of Transportation Research: Part A*, vol. 36, no. 7, pp. 593-611.
- Barter, P. A. 2006, 'Multiple dimensions in negotiating the cross-border transport links that connect and divide Singapore and Johor, Malaysia', *Asia Pacific Viewpoint*, vol. 47, no. 2, pp. 287-303.
- Bazeley, P. 2009, 'Integrating data analyses in mixed methods research', *Journal of Mixed Methods Research*, vol. 3, no. 3, pp. 203-207.
- Bazeley, P. & Kemp, L. 2011, 'Mosaics, triangles and DNA: Metaphors for integrated analysis in mixed methods research', *Journal of Mixed Method Research*, vol. 6, no. 1, pp. 55-72.
- Beattie, W., Scott, N., Badner, H. & Choi, P. 2001, 'Epidural analgesia reduces postoperative myocardial infarction: A meta-analysis', *Journal of Anesthesia & Analgesia*, vol. 93, no. 4, pp. 853-858.
- Beresford, A., Petit, S., Xu, Q. & Williams, S. 2012, 'A study of dry port development in China', *Journal of maritime economic and logistics*, vol. 14, no. 1, pp. 73-98.
- Beresford, A. & Dubey, R. C. 1990, 'Handbook on the management and operation of dry ports', in, United nation, Geneva, pp. 169-210.

- Bergqvist, R., 2016. *Dry Ports—A Global Perspective: Challenges and Developments in Serving Hinterlands*. Routledge.
- Berg, V. R. & Langen, D. 2015, 'Assessing the intermodal value proposition of shipping lines: Attitudes of shippers and forwarders', *Maritime Economics & Logistics*, vol. 17, no. 1, pp. 32-51.
- Bergqvist, R. 2013, *Hinterland transport in Sweden*: Ashgate publishing limited, England, pp. 13-28.
- Bergqvist, R., Woxenius, J. & Falkemark, G. 2010, Establishing intermodal terminal, *Transportation Research*, vol. 3, no. 3, pp. 285-302.
- Bernhofen, D. M., El-Sahli, Z. and Kneller, R., 2016, ' Estimating the effects of the container revolution on world trade', *Journal of International Economics*, vol. 98, no. 8, pp. 36-50.
- Berrien, F. K. 1976, *A general system approach to organizations*, Rand McNally College Publishing Company, Chicago.
- Bethlehem, J. & Biffignandi, S. 2012, *Handbook of Web Surveys*, Wiley, New Jersey.
- Bichou, K. 2004, 'The ISPS code and the cost of port compliance: An initial logistics and supply chain framework for port security assessment and management ', *Journal of Maritime Economic and Logistics*, vol. 6, pp. 322-348.
- Bichou, K. 2009, *Port operation planning and logistics*, Lloyd's practice shipping guides, London.
- Bichou, K. & Gray, R. 2004, 'A logistics and supply chain management approach to port performance measurement.', *Journal of Maritime Policy and Management*, vol. 31, no. 1, pp. 47-67.
- Bichou, K. & Gray, R. 2005, 'A critical review of conventional terminology for classifying seaports', *Journal of Transportation Research Part A: Policy and Practice* vol. 39, no. 1, pp. 75-92.
- Bird, J. H. 1963, *The major seaport of United Kingdom*, Hutchinson, London.
- Bird, J. H. 1984, *Seaport development: Some questions of scale in seaport systems and spatial*, Hutchinson, London.
- Black, J., Kyu, T., Roso, V. & K.Tara 2013, 'Critical evaluation of Mandalay dry port, Myanmar', *Proceedings of the 5th International conference on logistics and transport 2013 (ICLT 2013)" Sustainable Supply Chain Management in Asia Pacific"*, November 5-8, 2013, Doshisha University, Kyoto, Japan.

- Blaikie, A., Saines, A. D., Schmitthenner, M., Lankford, M., Pasteur, R. D. & Lindner, J. F. 2014, 'Order and chaos in the rotation and revolution of two massive line segments', *Physical Review E*, vol. 89, no. 4, p. 042917.
- Borjesson, L. & Lindberg, E. 2014, 'Recommendation for emission reporting to endeavor sustainable transports.' in, *Operational guidance to fortify sustainability in the Volvo Car Group's logistic network*, ed. S. Behrends, Chambers, University of Technology, Gothenburg, Sweden, pp. 1-74.
- Bowen, G. A. 2006, 'Grounded theory and sensitizing concepts', *International Journal of Qualitative Methods*, vol. 5, no. 3, pp. 12-23.
- Bowerman, B. L. & O'Connell, R. T. 1990, *Linear statistical models: An applied approach*, 2nd edn, Duxbury, Belmont, CA.
- Bozuwa, J., Gille, J., Modijefsky, M. & Schijndel, M. 2009, 'Strengthening the logistic hub', in *Infrastructure and services in dry ports*, ECORYS Netherlands BV Rotterdam.
- BPA 2014, 'Bintulu Port Authority: Port throughput statistics', http://www.bpa.gov.my/web/home/port_statistic/197/2013, accessed 14th September 2014.
- Brooks, M. 1984, 'An alternative theoretical approach to the evaluation of liner shipping- Part 1: Situational factors. ', *Journal of Maritime Policy and Management* vol. 11, no. 1, pp. 35-43.
- Brooks, M. 1985, 'An alternative theoretical approach to the evaluation of liner shipping Part 2: Choice criteria.', *Journal of Maritime Policy and Management* vol. 12, no. 2, pp. 145-155.
- Brooks, M. R., Pallis, T. & Perkins, S. 2014, 'International transport forum', in *Port investment and container shipping markets*, Organisation for Economic Co-operation and Development, Paris, pp. 10-18.
- Brown, M. G. & Stevenson, R. A. 1988, 'Measuring R&D productivity', *Journal of Technology Management*, vol. 31, no. 4, pp. 11-15.
- Bruce, L., Miiler, C., Libby, O. & Ritchey, B. 2013, *Observation on the potential for dry ports terminal developments in United States.*, Ashgate Publishing Company, England, 124-166.
- Bryman, A. 2007, 'Barriers to integrating quantitative and qualitative research', *Journal of Mixed Methods Research*, vol. 1, no. 1, pp. 8-22.
- Bullock, R., Sondhi, J. & Amos, P. 2009, 'Tracks from the past, transport for the future', in *China's Railway Industry 1990-2008 and its future plans and possibilities*, Work Bank, Ministry of Railway, China Country Office, Beijing., pp. 5-9.
- Cahoon, S. 2007, 'Marketing communications for seaports: a matter of survival and growth.', *Maritime Policy & Management*, vol. 34, no. 2, pp. 151-168.

- Carifio, J. & Perla, R. J. 2007, 'Ten common misunderstandings, misconceptions, persistent myths and urban legends about Likert scales and Likert response formats and their antidotes.', *Journal of Social Sciences*, vol. 3, no. 3, pp. 106-116.
- CDP 2013, 'Cikarang Dry Port (CDP): Integrated port and logistics facilities', www.cikarangdryport.com, vol. 2014, accessed 22nd July 2014.
- Cetin, C. K. & Cerit, A. G. 2009, 'Organisational change of seaports: Impact on effectiveness', *Proceedings of the Annual conference of International Association of Maritime Economists* 24-26 June 2009, Copenhagen, Denmark.
- Cetin, C. K. & Cerit, G. 2010, 'Organisational change and effectiveness in seaports from a systems viewpoint', in *The Handbook of Maritime Economics and Business*, ed. C. T. Grammenos, Lloyd's List, London pp. 947-984.
- Chamberlain, K., Camic, P. & Yardley, L. 2004, 'Qualitative analysis of experience: Grounded theory and case study', *Journal of Research Method* vol. 5, no. 2, pp. 56-68.
- Chang, Z., Notteboom, T. and Lu, J., 2015, 'A two-phase model for dry port location with an application to the port of Dalian in China', *Transportation Planning and Technology*, vol. 38, no. 4, pp. 442-464.
- Chang, S.J., Van Witteloostuijn, A. and Eden, L., 2010. From the editors: Common method variance in international business research. *Journal of International Business Studies*, 41(2), pp.178-184
- Charlier, J. 1992, 'The regeneration of old port areas for new port uses: European port cities in transition.', in *Seaport systems and spatial change*, London, pp. 137-154.
- Charmaz, K. 2006, 'The power of names', *Journal of Contemporary Ethnography*, vol. 35, no. 4, pp. 396-399.
- Chen, S. 2012, A mixed methods study investigating intangibles in the banking sector, thesis, University of Glasgow, Glasgow, UK.
- Chen, S. L., Jeevan, J. & Cahoon, S. 2015, 'Hinterland connectivity of Malaysian container seaports: Challenges and solutions', *Proceedings of the Global Integration of Economies and Connectivity Development in collaboration with Asian Logistics Round Table (ALRT)*, August 31-September 1, 2015, Soochow University Taipei, Taiwan.
- Chen, Z. & Sarker, B. 2014, 'An integrated optimal inventory lot-sizing and vehicle-routing model for a multi supplier single-assembler system with JIT delivery', *International Journal of Production Research*, vol. 52, no. 17, pp. 5086-5114.

- Chiu, S. L. 2000, 'Logistics services in Taiwanese maritime firms: Logistics and transportation review ', *Journal of Transportation Research: Part E*, vol. 36, no. 2, pp. 79-96.
- Christiaanse, E. & Kumar, K. 2000, ' ICT enabled coordination dynamics supply webs.', *Journal of Physical Distribution and Logistics Management*, vol. 30, no. 4, pp. 268-286.
- Christopher, M. 2005, *Logistics and supply chain management: Creating value adding network* 3rd edn, Pearson Education Limited., London.
- Christophersen, T. & Konradt, U. 2011, ' Reliability, validity, and sensitivity of a single-item measure of online store usability', *International Journal of Human-Computer Studies*, vol. 69, no. 4, pp. 269-280.
- Chuen, C., Karim, M. R. & Yusoff, S. 2014, 'Mode choice between private and public transport in Klang Valley, Malaysia', *The Scientific World Journal*, p. 14 pages.
- Collins, K. M. T., Onwuegbuzie, A. J. & Jiao, Q. G. 2007, 'A mixed method investigation of mixed methods sampling design in social and health science research', *Journal of Mixed Method Research*, vol. 1, no. 3, pp. 267-294.
- Collison, F. 1984, 'North to Alaska: marketing in the Pacific Northwest-Central Alaska liner trade', *Journal of Maritime Policy and Management*, vol. 11, no. 2, pp. 99-112.
- Comrey, A. L. & Lee, H. B. 1992, *Interpretation and application of factor analytic results*, 2nd edn, Lawrence Erlbaum Associates New Jersey.
- Cooper, D. R. & Schindler, P. S. 2011, *Business research method*, 11th edn, McGraw-Hill, New York.
- Cooper, D. R. & Schindler, P. S. 2014, *Business research methods*, 12th edn, McGraw Hill International Edition, New York.
- Corbin, J., & Strauss, A. 2014, *Basics of qualitative research: Techniques and procedures for developing grounded theory*, SAGE publication, United Kingdom
- Corbin, J. & Strauss, A. 2008, *Basics of qualitative research: Techniques and procedures for developing grounded theory*, 3rd edn, SAGE publication, United Kingdom.
- Corbin, J. M. & Strauss, A. 1990, 'Grounded theory research: procedures, canons, and evaluative criteria', *Journal of Qualitative Sociology* vol. 13, no. 1, pp. 3-21.
- Costello, A. B. 2005, 'Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis, practical assessment ', *Research and Evaluation*, vol. 10, no. 7.

- Couper, S. 2004, 'A comparison of web and mail survey response rates', *Journal of Public Opinion Quarterly*, vol. 68, no. 1, pp. 94-101.
- Creswell, J. W. 2008, *Educational research: Planning, conducting and evaluating quantitative and qualitative research*, 3 edn, Kevin M. Davis, New Jersey.
- Creswell, J. W. 2009, 'Editorial: Mapping the field of mixed methods research.', *Journal of Mixed Methods Research*, vol. 3, no. 2, pp. 95-108.
- Creswell, J. W. 2012, *Educational Research: planning, conducting and evaluating quantitative and qualitative research*, 4th edn, Pearson, Boston, MA.
- Creswell, J. W. 2013, *Research design: Qualitative, quantitative, and mixed methods approaches*, SAGE publication, New Jersey.
- Creswell, J. W. & Amanda, L. G. 2008, 'The movement of mixed methods research and the role of educators', *South African Journal of Education*, vol. 28, no. 3, pp. 321-333.
- Creswell, J. W. & Clark, L. P. 2007, *Designing and conducting mixed methods research*, 1st edn, Thousand Oaks, Calif.: SAGE publication, USA.
- Creswell, J. W. & Clark, L. P. 2011, *Designing and conducting mixed methods research*, 2nd edn, Thousand Oaks, CA: SAGE publication., London.
- Creswell, J. W. & Tashakkori, A. 2007, 'Editorial: Developing publishable mixed methods manuscripts', *Journal of Mixed Methods Research*, vol. 1, no. 2, pp. 107-111.
- Crowe, M., Sheppard, L. & Campbell, A. 2012, 'Reliability analysis for a proposed critical appraisal tool demonstrated value for diverse research designs.', *Journal of Clinical Epidemiology*, vol. 65, no. 4, pp. 375-383.
- Cruijsen, F., Cools, M. & Dullaert, W. 2007, 'Horizontal cooperation in logistics: opportunities and impediments.', *Journal of Transportation Research: Part E*, vol. 43, no. 2, pp. 129-142.
- Cullinane, K., Bergqvist, R. & Wilmsmeier, G. 2012, 'The dry port concept: Theory and practice', *Journal of Maritime Economics & Logistics* vol. 14, no. 1, pp. 1-13.
- Cullinane, K. P. & Wilmsmeier, G. 2011, 'Handbook of terminal planning: The contribution of the dry port concept to the extension of port life cycles', in *Operations Research Computer Science interfaces series*, New York, pp. 359-380.
- Curtis, B. 2009, 'The Chirundu Border Post - Detailed Monitoring of Transit Times, *Sub-Saharan Africa Transport Policy Program*.' in, The World Bank, Washington DC.
- Daniela, A. & Sciomachen, A. 2014, 'Location of Mid-range Dry Ports in Multimodal Logistic Networks', *Procedia-Social and Behavioral Sciences*, vol. 10, no. 8, pp. 118-128.

- Daugherty, P., Patricia, J., Matthew, B. & Richey, R. G. 2002, ' Information support for reverse logistics: the influence of relationship commitment', *Journal of Business Logistics*, vol. 23, no. 1, pp. 85-106.
- Dawes, J. 2008, 'Do data characteristics change according to the number of scale points used?', *International Journal of Market Research*, vol. 50, no. 1, pp. 61-77.
- Debelić, B., Grubišić, N. and Milanović, S. 2016, 'The cost and non-cost conditionality of transport corridor logistics performances as determinant of port competitiveness', *Business Logistics in Modern Management*, vol. 1, pp. 145-158.
- Denzin, N. K., Yvonna, S. & Giardina, M. D. 2006, 'Disciplining qualitative research 1', *International Journal of Qualitative Studies in Education* vol. 19, no. 6, pp. 769-782.
- Dillman, D. A. 2002, 'Presidential address, Navigating the rapids of change: Some observations on survey methodology in the early twenty-first century.', *Public Opinion Quarterly*, pp. 473-494.
- Dillman, D. A., Smyth, J. & Christian, L. 2009, *Internet, mail and mixed mode surveys: The tailored design method*, John Wiley & Sons, New York.
- Dollah, R., M & Mohammad, A. M. 2010, 'Malaysia–Indonesia Barter Trade: Opportunities and challenges', *Journal of Southeast Asian Studies*, vol. 12, no. 1, pp. 411-419.
- Dotoli, M., Fanti, M. P., Mangini, A. M., Steco, G. & Ukovich, W. 2010, 'The impact of ICT on international transportation systems: A modelling approach.', *Journal of Engineering Practice*, vol. 18, no. 6, pp. 893-903.
- Douglas, H., Tae, C. Y., Lee, J. S., Dholakia, N. & Olivier, D. 2014, 'The balanced theory of port competitiveness', *Proceedings of the International Association of Maritime Economists* 15-18 July, Norfolk, Virginia USA.
- Doust, K. & Black, J. 2009, 'A holistic assessment framework for urban development and transportation with innovative triple bottom line sustainability metrics – An International Perspective', *MIT Journal of Planning*, vol. 9, pp. 10-27.
- DuBrin, A. J. 2003, *Essentials of Management*, 6thedn, Thomson South-Western, Peterborough, Ontario.
- Easterby, S. M., Thorpe, R. & Jackson, P. R. 2008, *Management Research*, 3rd edn, SAGE publication, London.
- Eaves, Y. D. 2001, ' A synthesis technique for grounded theory data analysis.', *Journal of Advanced Nursing*, vol. 35, no. 5, pp. 654-663.
- Ecorys, B. V. 2011, 'Pre-feasibility study, review of PPP options and optimum option for establishment of the Kisarawe Freight Station', in *Strengthening the logistic hub.*, Rotterdam, pp. 63-89.

- Eichhorn, B.R., 2014. Common Method Variance Techniques. *Cleveland State University, Department of Operations & Supply Chain Management. Cleveland, OH: SAS Institute Inc.*
- EPU 2015, 'The logistics and trade facilitation masterplan', in, *Economic Planning Unit, Kuala Lumpur, Malaysia.*
- Eric, L. M., Gabriel, P. S. & Ricardo, J. 2013, *Potential for logistics zones development: Chile as a case study*, Ashgate publishing company, England, pp 233-249.
- Eshuis, J., Braun, E. and Klijn, E.H. 2013, 'Place marketing as governance strategy: An assessment of obstacles in place marketing and their effects on attracting target groups.', *Public Administration Review*, vol. 73, no. 3, pp. 507-516.
- European Commission 2000, '*Promotion of intermodality and intermodal freight transport in the European Union*', in, pp. 1-2.
- Evers, H. D., & Gerke, S 2006, '*The strategic importance of the Straits of Malacca for world trade and regional development* ', in, Department of Political and Cultural Change, Center for Development Research, University of Bonn, Germany, pp. 1-20.
- EYGM 2014, 'Ernst & Young Global Limited, *The rise of Kuala Lumpur as an investment destination*', in Well-developed infrastructure, ed. A.R.Rasyid, Kuala Lumpur.
- Fabian, P., Gerlici, J., Masek, J. & Marton, P. 2013, 'Versatile, efficient and long wagon for intermodal transport in Europe', in *Communication: scientific letter*, University of Zilinia, pp. 118-123.
- FDT 2007, 'Feasibility study on the network operation of hinterland hubs (Dry Port Concept) to improve and modernize ports' connections to the hinterland and to improve networking', in *Integrating Logistics Center Networks in The Baltic Sea Region (INLOC)*, Netherlands, pp. 21-64.
- Fechner, I. 2010, 'Role of logistics centre in national logistics system', *Electronic Scientific Journal of Logistics*, vol. 6, no. 2, pp. 9-18.
- Feng, X., Zhang, Y., Li, Y. & Wang, W. 2013, 'A location allocation model for seaport-dry port system optimization', *Journal of Discrete Dynamics in Nature and Society*, pp. 1-9.
- Field, A. 2009, *Discovering statistics using SPSS*, SAGE publication, London.
- Fink, A. 2002, *The survey handbook*, Thousand Oaks, SAGE publication, California.
- Floersch, J., Jeffery, L., Longhoofer, L. & Kranke, D. 2010, 'Integrating thematic, grounded theory and narrative analysis.', *Journal of Qualitative Social Work*, vol. 9, no. 3, pp. 407-425.

- Franklin, C., and Jordan, C. 1997, Qualitative approaches to the generation of knowledge', social work research and evaluation: *Quantitative and Qualitative Approaches*, Peacock Publishers, Illinois.
- Fraser, D. & Notteboom, T. 2012, 'Gateway and hinterland dynamics: The case of the Southern African container seaport system', *African Journal of Business Management* vol. 6, no. 44, pp. 10807-10825.
- Frémont, A. & Franc, P. 2010, 'Hinterland transportation in Europe: Combined transport versus road transport.', *Journal of Transport Geography*, vol. 18, no. 6, pp. 548-556.
- Fricker, R. D. 2008, *Sampling methods for web and e-mail survey*, SAGE publication, London.
- Frost, J. D. 2010, 'The “close” dry port concept and the Canadian context.', *Journal of Maritime Economics & Logistics*, vol. 10, no. 2, pp. 108-129.
- Galloni, G. 1999, ' *Quality of freight villages structure and operations*. Final Report for Publication. Europlatforms E.E.I.G. ', in, European Commission p. 79.
- Garnwa, P., Beresford, A. & Pettit, S. 2009, 'Dry ports: A comparative study of the UK and Nigeria.', in *UNESCAP Transport and Communications Bulletin for Asia and the Pacific*, United Nation, pp. 58-81.
- Garver, M. S., Williams, Z. & Taylor, G. S. 2008, 'Employing latent class regression analysis to examine logistics theory: An application of truck driver retention', *Journal of Business Logistics*, vol. 29, no. 2, pp. 233-257.
- Ghani, N. M., Jeevan, J., Mokhtar, K. and Hamid, S.A., 2011, 'Port development: Competitive factor in value chain', *Journal of Global Management*, vol. 2, no. 2, pp. 163-177.
- Gibbs, L., Kealy, M., Willis, K., Green, J., Welch, N. & Daly, J. 2007, ' What have sampling and data collection got to do with good qualitative research?.', *Australian and New Zealand Journal of Public Health*, vol. 31, no. 6, pp. 540-544.
- Glaser, B. G. 1992, *Basics of grounded theory analysis*, Mill Valley: Sociology Press, London.
- Gosling, S. D., Srivastava, V. S. & John, O. P. 2004, 'Should we trust web-based studies? A comparative analysis of six preconceptions about internet questionnaires.', *American Psychologist*, vol. 59, no. 2, p. 93.
- Goulding, C. 2005, 'Grounded theory, ethnography and phenomenology: A comparative analysis of three qualitative strategies for marketing research.', *European Journal of Marketing*, vol. 3, no. 4, pp. 294-308.
- Government of Egypt 1999, in *Reducing transport costs of Egypt's exports*, Ministry of Trade and Supply, U.S. Agency for International Development, Cairo, Egypt.

- Graneheim, U. H. & Lundman, B. 2004, 'Qualitative content analysis in nursing research: Concepts, procedures and measures to achieve trustworthiness', *Journal of Nurse Education Today*, vol. 24, no. 2, pp. 105-112.
- Gray, R. & Kim, G. 2001, 'Hinterland development and prospect in Busan', in *Logistics and International Shipping*, Institute of International Maritime Affairs, Busan, Republic of Korea.
- Greene, J. C. & Caracelli, V. J. 1997, 'Defining and describing the paradigm issue in mixed-method evaluation.', *Journal of New Directions for Evaluation* vol. 2, no. 4, pp. 5-17.
- Gross, R. O. 1990, 'Economic policies and seaports, Part 1: The economic functions of seaports', *Journal of Maritime Policy and Management*, vol. 17, no. 3, pp. 207-209.
- Gujar, G. & Thai, V. V. 2013, 'Measurement of container security at dry ports.', in *International Forum on Shipping, Ports and Airports (IFSPA) 2013: Trade, Supply Chain Activities and Transport: Contemporary Logistics and Maritime Issues*.
- Haezendonck, E., Dooms, M., & Verbeke, A. 2014, 'A new governance perspective on port–hinterland relationships: The port hinterland impact (PHI) matrix.', *Journal of Maritime Economics & Logistics.*, vol. 16, no. 3, pp. 229-249.
- Haezendonck, E. & Notteboom, T. 2002, '*The competitive advantage of seaports*. Port Competitiveness: An economic and legal analysis of the factors determining the competitiveness of seaports', in, Antwerp: De Boeck., pp. 67–88.
- Haezendonck, E., Pison, G., Rousseeuw, P., Struyf, A. & Verbeke, A. 2001, 'The core competencies of the Antwerp seaport: An analysis of “port specific” advantages.', *Journal of Transport Economics* vol. 28, no. 3, pp. 325-349.
- Hair, J. F., Black, W.C., Babin, B. & Anderson, R.E. 2010, *Multivariate Data Analysis: A Global Perspective*, 7thedn, Pearson., London.
- Hall, P. 2002, City and regional planning: *The institution of infrastructure and the development of the port regions*, Ph.D thesis, University of California, Berkeley, CA, Berkeley.
- Hanaoka, S. & Regmi, M. B. 2011, 'Promoting intermodal freight transport through the development of dry ports in Asia: An environmental perspective', *Journal of International Association of Traffic and Safety Science*, vol. 35, no. 1, pp. 16-23.
- Haralambides, H. & Acciaro, M. 2010, *International handbook of maritime business*, Edward Elgar Publishing Inc., United Kingdom, pp. 123-149.
- Haralambides, H. & Gujar, G. 2012, 'On balancing supply chain efficiency and environmental impacts: An ECO-DEA model applied to the dry port sector of India.', *Maritime Economics and Logistics*, vol. 14, no. 1, pp. 7-16.

- Haralambides, H., Veldman, S., Drunen, E. V. & Liu, M. 2011, 'Determinants of a regional port-centric logistics hub: The case of East Africa', *Journal of Maritime Economics & Logistics*, vol. 13, no. 1, pp. 78-97.
- Haralambides, H. E. & Gujar, G. 2011, 'Dry port efficiency and container security', *Proceedings of the IAME 26th – 28th of October 2011*, Santiago De Chile.
- Hatch, T. 2001, 'Incoherence in the system: Three perspectives on the implementation of multiple initiatives in one district.', *American Journal of Education*, vol. 2, no. 3, pp. 407-437.
- Hayuth, Y. 1981, 'Containerization and the load centre concept', *Journal of Economy Geography*, vol. 57, no. 10, pp. 160-167.
- Hayuth, Y. 1988, 'Rationalisation and deconcentration of the US container port system', *Journal of Economic Geography*, vol. 40, no. 12, pp. 279-288.
- Heaver, T. 2001, 'The evolving roles of shipping lines in international logistics', *Journal of Maritime Economics*, vol. 4, no. 3, pp. 210-230.
- Heaver, T., Meersman, H., Moglia, F. & Voorde, E. V. D. 2000, 'Do mergers and alliances influence European shipping and port competition? ', *Journal of Maritime Policy and Management*, vol. 27, no. 4, pp. 363-373.
- Heilig, L. & Voß, S. 2016, 'Inter-terminal transportation: An annotated bibliography and research agenda', *Flexible Services and Manufacturing Journal*, vol. 28, no. 97, pp. 1-29.
- Henttu, V. & Multaharju, S. 2011, 'Transshipment costs of intermodal transport in Finnish context.', in *Tutkimusraportti Research Report* Faculty of Technology Management. Department of Industrial Management, Lappeenranta University of Technology, Finland.
- Hesse, M. & Rodrigue, J. 2004, 'The transport geography of logistics and freight distribution', *Journal of Transport Geography*, vol. 12, no. 3, pp. 171-184.
- Higgins, C. & Ferguson, M. 2011, 'An exploration of the freight village concept and its applicability to Ontario.', in Ontario Ministry of Transportation: McMaster Institute for Transportation and Logistics, McMaster University Hamilton, Ontario.
- Hjern, B. & Porter, O. 1981, 'Implementation Structures: A new unit of administrative analysis', *Journal of Organization Studies* vol. 2, no. 3, pp. 211-227.
- Hong, Z. 2015, 'Trends in Southeast Asia', in *China's new maritime silk road: Implications and opportunities for southeast Asia.*, eds. S. A. Oh, O.K.Bee & T. Chong, Institute of Southeast Asia Studies, Singapore.
- Horst, V. D. & Langen, W. 2008, 'Coordination in hinterland transport chains: A major challenges for seaport community.', *Journal of Maritime Economics & Logistics*, vol. 10, no. 6, pp. 108-129.

- Horst, V. D., Larissa & Lugt, L. M. 2011, 'Coordination mechanisms in improving hinterland accessibility: Empirical analysis in the port of Rotterdam', *Journal of Maritime Policy & Management*., vol. 38, no. 4, pp. 415-435.
- Horst, V. D., Larissa, M. & Langen, L. M. 2011, 'Coordination mechanisms in improving hinterland accessibility: Empirical analysis in the port of Rotterdam', *Journal of Maritime Policy & Management*., vol. 38, no. 4, pp. 415-435.
- Hoyle, B. S. 1968, 'East African seaports: An application of the concept of anyport.', *Transactions of the Institute of British Geographers*., vol. 44, pp. 163-168.
- Huang, W. C., Chen, K. L. & Chien, C. W. 2003, 'Port competitiveness evaluation by fuzzy multi criteria grade classification model', *Journal of Marine Science and Technology*, vol. 11, no. 1, pp. 53-60.
- Humphries, A. M. 2004, 'Growth Triangle of South East Asia', in *Indonesia – Malaysia – Singapore Growth Triangle* ed. A. Duffy, Australia, pp. 29-49.
- Hurley, A. E., Scandura, T.A., Schriesheim, C.A., Brannick, M.T., Seers, A., Vandenberg, R.J. and Williams, L.J., 1997, ' Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives.' *Journal of Organizational Behavior*., vol. 18, no. 6, pp. 667-683.
- ICT 2015, 'Ipoh Cargo Terminal: Port and value added services', <http://www.ictipoh.com.my/>, accessed 18th April 2015.
- IMT-GT 2012, 'Implementation of Blueprint of Indonesia-Malaysia-Thailand Growth Triangle ', in *The 6th Summit of Indonesia-Malaysia-Thailand Growth Triangle*, Phnom Penh, Cambodia.
- Ishak, Y. & Kasim, Y. 2004, 'Cooperation within BIMP-EAGA: Issues and future directions ', *Asia-Pacific Development Journal*, vol. 10, no. 2, p. 41.
- Israel, M. & Hay, L. 2006, *Research ethics for social scientist*, SAGE Publications, Ltd, London.
- Ivankova, N. V., Creswell, J. W. & Stick, S. L. 2006, ' Using mixed-methods sequential explanatory design: From theory to practice', *Journal of Field Methods*, vol. 18, no. 1, pp. 3-20.
- Janice, M., Niehaus, L., Wolfe, R. & Wilkins, S. 2006, 'The role of theoretical drive in maintaining validity in mixed-method research', *Journal of Qualitative Research in Psychology*, vol. 3, no. 4, pp. 279-291.
- Jarzemskis, A. & Vasiliauskas, V. 2007, 'Research on dry port concept as intermodal node', *Journal of Transportation Economics*, vol. 22, no. 3, pp. 207-213.

- Jeevan, J., Chen, S. L. & Lee, E. S. 2015, 'The challenges of Malaysian dry ports development', *The Asian Journal of Shipping and Logistics* vol. 31, no. 1, pp. 109-134.
- Jeon, I., Kim, S. & Kim, H. S. 1993, 'Strategy for improvement of competitive power in Korean container port', *Journal of the Korean Association of Shipping Studies*, vol. 30, no. 6, pp. 253-280.
- Jeremey, P. 2014, 'China sees itself at center of new Asian order: Beijing builds roads, pipelines, railways and ports to bind itself to region', <http://www.wsj.com/articles/chinas-new-trade-routes-center-it-on-geopolitical-map-1415559290>, accessed 5th July 2016.
- Jian, L. & Jiang, B. 2014, 'Cooperation performance evaluation between seaport and dry port; Case of Qingdao Port and Xi'an Port ', *International Journal of E-Navigation and Maritime Economy*, vol. 1, pp. 99-109.
- Jick, T. D. 1979, 'Qualitative and quantitative methods: Triangulation in action', *Journal of Administrative Science*, vol. 24, no. 4, pp. 602-611.
- Johnson, R. B., Onweugbuzie, A. J. & Turner, L. A. 2007, 'Towards a definition of a mixed methods research', *Journal of Mixed Method Research*, vol. 1, no. 2, pp. 112-133.
- Johnson, R. B. & Onwuegbuzie, A. J. 2004, 'Mixed methods research: A research paradigm whose time has come', *Journal of Educational Researcher*, vol. 33, no. 7, pp. 14-26.
- JPA 2014, 'Johor Port Statistics; Johor Port ', <http://www.lpj.gov.my/ms/pusat-maklumat/statistik-jpb>, accessed 14th September 2014.
- Jugovic, A., Bisticic, A. & Hadzic, A. P. 2011, 'Organisation of Croatian country seaport management system', *Journal of Contemporary Management Issues*, vol. 16, no. 2, pp. 43-69.
- Kanafani, A. & Wang, R. 2010, 'Measuring multimodal transport level of service', in, University of California Transportation Center University of California, Berkeley, p. 55.
- Kapros, S. 2003, 'Freight village evaluation under uncertainty with public and private financing', *Journal of Transport Policy*, vol. 10, no. 4, pp. 141-156.
- Kasyapi, M. & Shah, M. Z. 2006, 'A Regression model for vessel turnaround time', *Proceedings of the Tokyo Academic Industry & Culture Integration Tour 2006*, Shibaura Institute of Technology, Japan.
- Keith, T. 2006, *Multiple regression and beyond*, PEARSON Allyn & Bacon, United States.

- Kemper, E. A., Stringfield, S. & Teddlie, C. 2003, *Mixed methods sampling strategies in social science research*, SAGE Publication, Thousand Oaks, CA.
- Kendall, J. & Judy, K. 1999, 'Axial coding and the grounded theory controversy', *Western Journal of Nursing Research*, vol. 21, no. 6, pp. 743-757.
- Keong, C. H., Hewitt, J. & Chew, T. H. 2012, 'Singapore: Scoping baseline information for forest law enforcement, governance and trade', in, forest law enforcement, governance and trade Kuala Lumpur, Malaysia.
- Kim, H. G., Choi, C. Y., Woo, J. W., Choi, Y., Kim, K., & Wu, D. D. 2011, 'Efficiency of the modal shift and environmental policy on the Korean railroad.', *Journal of Stochastic Environmental Research and Risk Assessment*, vol. 25, no. 3, pp. 305-322.
- Kim, H. S. 1993, 'Decision components of shippers' port choice in Korea.', *Journal of the Korean Association of Shipping Studies*, vol. 31, no. 4, pp. 117-136.
- Kim, O. J., Park, B. J., Sohn, D. R., Lee, S. M. & Shin, S. G. 2003, 'Current status of the institutional review boards in Korea: Constitution, operation, and policy for protection of human research participants', *Journal of Korean Medical Science*, vol. 18, no. 1, pp. 3-10.
- Klassen, A. C., Creswell, J., Plano Clark, V. L., Smith, K. C. & Meissner, H. I. 2012, 'Best practices in mixed methods for quality of life research', *Quality of Life Research*, vol. 21, no. 3, pp. 377-80.
- Kline, P. 1994, *An easy guide to factor analysis*, Routledge, London.
- Klink, H. A. 2000, 'Optimisation of land access to sea ports', *Proceedings of the Land Access to Sea Ports, European Conference of Ministers of Transport.*, Rotterdam.
- Knowler, G. 2014, 'New China-Europe rail link offers door-to-door service ', <http://www.joc.com/rail-intermodal/new-china-europe-rail-link-offers-door-door-service-20140917.html?mgs1=4561hi7DpG>; *Journal of Commerce*, accessed 18th September 2014.
- KPA 2014, 'Kuantan Port Authority', http://www.lpkn.gov.my/v3r4/index.php?option=com_content&view=article&id=19&Itemid=8, accessed 14th September 2014.
- KSB 2014, 'Kemaman Supply Base', <http://www.epicgroup.com.my/sub1.php>, accessed 14th September 2014.
- Kunaka, C. 2013, 'Dry ports and trade logistics in Africa', in *Dry ports: A global perspective*, Ashgate Publishing Limited., Great Britain, pp. 83-109.

- Lam, J. & Yap, W. 2011, 'Dynamics of liner shipping network and port connectivity in supply chain systems: Analysis on East Asia.', *Journal of Transport Geography*, vol. 19, no. 6, pp. 1272-1281.
- Langen, D. & Lugt, L. M. 2007, 'Government structure of port authorities in the Netherlands: Devolution, port governance and port performance', *Journal of Transportation Economics*, vol. 17, no. 5, pp. 109-137.
- Lavigne, G. M. 2014, 'Top 50 container ports: Growth in Asia reigns supreme', <http://www.joc.com/port-news/port-productivity/top-50-container-ports-growth-asia-reigns-supreme-interactive-20141009.html>, accessed 11th October 2014.
- Lee, P.T.W. and Lam, J.S.L., 2016. Developing the Fifth Generation Ports Model. In *Dynamic Shipping and Port Development in the Globalized Economy* (pp. 186-210). Palgrave Macmillan UK.
- Leszek, A. & Fechner, I. 2012, 'Case study: Dry port development; Poznan, Poland', in *Towards an integrated transport system in the Baltic Sea Region*, Institute of Logistics and Warehousing, Poznan, Poland.
- Leveque, P. & Roso, V. 2002, 'Dry port concept for seaport inland access with intermodal solutions', in *Master's Thesis, Department Of Logistics And Transportation, Chalmers University of Technology*.
- Li, K. X., Luo, M. & Yang, J. 2012, 'Container port systems in China and the USA: A comparative study', *Journal of Maritime Policy & Management*, vol. 39, no. 5, pp. 461-478.
- Lirn, T. C., Thanopoulou, H. A., Beynon, M. J. & Beresford, A. K. C. 2004, 'An application of AHP on transshipment port selection: A global perspective.', *Journal of Maritime Economics & Logistics*, vol. 6, no. 1, pp. 70-91.
- Locke, A., Edwin, A. & Latham, G. P. 2002, 'Building a practically useful theory of goal setting and task motivation: A 35-year odyssey', *Journal of American Psychologist*, vol. 57, no. 9, pp. 705-712.
- Lu, C. S. 2000, 'Logistics services in Taiwanese maritime firms ', *Journal of Transportation Research Part: E* vol. 36, no. 2, pp. 79-96.
- Lun, Y. 2009, 'Fleet mix in container shipping operation.', *Journal of Shipping And Transport Logistics.*, vol. 1, no. 2, pp. 103-118.
- Lun, Y. & Cariou, P. 2009, 'An analytical framework for managing container terminal', *Journal of Shipping And Transport Logistics.*, vol. 1, no. 4, pp. 419-436.
- Mak, J. & Tai, B. K. 2010, 'Port development within the framework of Malaysia's transport policy: Some considerations', *Journal of Maritime Policy & Management*, vol. 28, no. 2, pp. 199-206.

- Malaysia Freight Transport 2012, 'Malaysia freight transport report: Part of BMI's industry survey & forecasts series', in, 85 Queen Victoria Street London, p. 42.
- Malaysian Marine Department 2016, 'Objective of Malaysian Marine Department', http://www.marine.gov.my/jlmeng/Contentdetail.asp?article_id=221&category_id=2&subcategory_id=2&subcategory2_id=0#.VtufFvl96Uk, accessed 6th March 2016.
- Malaysian Railway 2012, 'Malaysian Railway', in *Railway Asset Corporation; Malaysia railway performance from the logistics point of view*, Ministry of Transportation Malaysia, Selangor, Malaysia, pp. 16-20.
- Malaysian Railway 2016, 'Cargoes', <http://www.ktmb.com.my/ktmb/index.php?r=portal/left&id=dWtWNWdWVnl3MWhiTTUwQkpzZVdFUT09&sub=eWEwaUp6TnZtdW4zdU5XSXZEaWh5dz09>, accessed 2nd March 2016.
- Malchow, M. & Kanafani, A. 2001, 'A disaggregate analysis of factors influencing port selection.', *Journal of Maritime Policy and Management*, vol. 28, no. 3, pp. 265-277.
- Mangan, J., Lalwani, C. & Fynes, B. 2008, 'Port-centric logistics', *International Journal of Logistics Management*, vol. 19, no. 1, pp. 29-41.
- Marshall, C. & Rossman, G. B. 2011, *Designing qualitative research*, 5th edn, Thousand Oaks: SAGE publication, California.
- Martine, V. S. & Jankowski, N. W. 2006, 'Conducting online surveys', *Journal of Quality and Quantity*, vol. 40, no. 3, pp. 435-456.
- Martino, M. D. 2003, 'The changing role of ports in supply-chain management: An empirical analysis', *Journal of Maritime Policy and Management* vol. 30, no. 4, pp. 305-320.
- Mašek, J., Kolarovszki, P. and Čamaj, J., 2016, 'Application of RFID technology in railway transport services and logistics chains', *Procedia Engineering*, vol. 134, pp. 231-236.
- Masriq, E. 2012, 'Development of integrated transport and logistics system in ASEAN and Pacific subregion', in *Malaysia: Key logistics and transport system (Road and Rail)*, Ministry of Transportation, Malaysia, Bangkok.
- McCalla, R. 1994, 'Canadian container: how have they fares? How will they do?', *Journal of Maritime Policy and Management* vol. 21, no. 3, pp. 207-217.
- McCalla, R. 2007, 'Factors influencing the landward movement of containers: The cases of Halifax and Vancouver.', *Proceedings of the International Workshop on Ports, Cities and Global Supply Chains* Hong Kong, China, pp. 121-137.

- McNamara, C. 1999, *General guidelines for conducting interviews*, John Wiley and Sons, Minnesota.
- Meersman, H. E., Voorde, V. D. & Vanelander, T. 2010, 'Port competition revisited', *Journal of Business and Economic Literature* vol. 55, no. 2, pp. 210-233.
- Merriam, S. B. 2002, *Introduction to qualitative research*, 1stedn, Jossey- Bass, San Francisco, CA.
- Migliardi, A., Beretta, E. & Vacche, A. D. 2013, 'The port of Genoa: A gateway for the North West of Italy', *Proceedings of the International Association of Maritime Economists*, July 3-5, Marseille, France.
- Mileski, J., Mejia, M. & Ferrell, T. 2014, 'The effects of port security compliance on the competitiveness of United States and European Union ports and maritime industry terminal firms', *Proceedings of the International Association of Maritime Economists*, July 15-18, Norfolk VA USA.
- MIMA 2014, 'Maritime Institute of Malaysia, *Malaysian Ports*', <http://www.mima.gov.my/mima/web-links/malaysian-ports/>, accessed 13th September 2014.
- MIMA 2015, 'Maritime Institute of Malaysia: *Malaysian ports and jetties*', <http://www.mima.gov.my/mima/web-links/Malaysian-ports/minor-ports-and-jetties>, accessed 12th March 2015.
- Minckler, C. H. 2011, *Teacher social capital: The development of a conceptual model and measurement framework with application to educational leadership and teacher efficacy*, PhD Thesis, University of Louisiana at Lafayette.
- MITI 2013, 'Ministry of International Trade and Industry: Driving transformation powering growth', in *International trade and economic momentum*, Jalan Duta, Kuala Lumpur.
- Monios, J., 2016. *Institutional Challenges to Intermodal Transport and Logistics: Governance in Port Regionalisation and Hinterland Integration*. Routledge.
- Monios, J. & Bergqvist, R. 2015, 'Intermodal terminal concessions: Lessons from the port sector.', *Research in Transportation Business & Management*, vol. 14, pp. 90-96.
- Monios, J., Notteboom, T., Wilmsmeier, G. & Rodrigue, J. P. 2016, 'Competition and complementarity between seaports and hinterlands for locating distribution activities', in *Port Economics Discussion Report*, Chios, Greece.
- Monios, J. & Wilmsmeier, G. 2014, 'The impact of container type diversification on regional British port development strategies', *Journal of Transport Reviews*, vol. 22, no. 8, pp. 1-22.
- Monios, J. and Wilmsmeier, G. 2012, Giving a Direction to Port Regionalisation, *Transportation Research Part A: Policy and Practice*, vol. 46, pp. 1551–1561.

- Morse, J. M. & Mitcham, C. 2002, 'Exploring qualitatively-derived concepts: inductivedeductive pitfalls', *International Journal of Qualitative Methods* vol. 1, no. 3.
- MOT 2012, 'Strategic plan for Ministry of Transportation Malaysia', in *Malaysian port and shipping towards the globalisation*, Ministry Of Transportation Malaysia Putrajaya, Malaysia, pp. 31-36.
- MOT 2013, 'Transport statistics of Malaysia', in, Department of transportation, Malaysia, p. 117.
- MOT 2014, 'Ministry of Transportation, Malaysia', <http://www.mot.gov.my/my/Statistics/Pages/Maritime.aspx>, accessed 14th September 2014.
- MOT 2015, 'Ministry of Transportation, Malaysia.', <http://www.mot.gov.my/en/Statistics/Pages/Maritime.aspx>, accessed 5th May 2015.
- Mueller, M. A., Wiegmanns, B. W., Duin, J. H. R. V., Buckmänn, E. H. & Zuidwijk, R. A. 2014, 'Modelling container port competition: Northern Europe versus Southern Europe', *Proceedings of the International Association of Maritime Economists*, July 15-18, Norfolk VA USA.
- Murphy, P., Dalenberg, D. & Daley, J. 1988, ' A contemporary perspective on international port operations.', *Journal of Transportation* vol. 28, no. 1, pp. 23-32.
- Murphy, P., Dalenberg, D. & Daley, J. 1989, 'Assessing international port operations', *International Journal of Physical Distribution and Materials Management*, vol. 19, no. 9, pp. 3-10.
- Murphy, P., Dalenberg, D. & Daley, J. 1991, 'Analysing international water transportation: The perspectives of large U.S. industrial corporations.', *Journal of Business Logistics* vol. 12, no. 1, pp. 169-190.
- Murphy, P., Dalenberg, D. & Daley, J. 1992, 'Port selection criteria: An application of a transportation research framework.', *Logistics and Transportation Review*, vol. 28, no. 3, pp. 237-255.
- Mussone, L., Grant-Muller, S. and Laird, J. 2015, 'Sensitivity analysis of traffic congestion costs in a network under a charging policy.', *Case Studies on Transport Policy*, vol. 3, no. 1, pp. 44-54.
- Naidu, G. 2008, 'Infrastructure development in Malaysia', in *International Infrastructure Development in East Asia – Towards Balanced Regional Development and Integration ERIA Research Project*, ed. N. Kumar, Institute of Developing Economies, Chiba, pp. 204-207.
- Nasir, S. 2014, *Intermodal container transport logistics to and from Malaysian ports; Evaluation of Customer requirements and environmental effects*, PhD thesis, Royal Institute of Technology (KTH) Stockholm, Sweden.

- Nations Online 2015, 'Regions in South-East Asia ', http://www.nationsonline.org/oneworld/map_of_southeast_asia.htm, accessed 16th July 2015.
- Nam, H.K & Song, D.W, 2011, Defining maritime logistics hub and its implication for container port, *Maritime Policy & Management*, vol:38, no.3, pp. 269-292,
- Nazery, K. 2007, 'Port privatization in the context of a developing nation: The Malaysian experience.'" *Restructuring of Indian ports: Reforms and challenges*', in, The Institute of Chartered Financial Analysts of India, Hyderabad, India.
- Nazery, K. 2013, 'The development of port and shipping sector in Malaysia', *Maritime Institute Of Malaysia*, vol. 20, no. 1, pp. 6-12.
- Nazery, K. 2014, *Transnational dynamics in Southeast Asia: Dry ports policy and the economic integration process on the western corridor of Peninsular Malaysia*, Institute of Southeast Asia, Singapore.
- Nazery, K., Margaret, A. & Cory, E. 2011, 'Assessing the issues, challenges and prospects of selected secondary ports in peninsular Malaysia', in, *Maritime Institute of Malaysia*, Centre for Maritime Economics and Industries.
- Nazery, K., Ang, M. & Hasan, C. A. 2012, 'Secondary ports in Malaysia: Unsung heroes', *Maritime Institute Of Malaysia*, vol. 19, no. 1, pp. 6-15.
- NCIA 2011, '*Northern corridor implementation authority* ', in, Prime Minister Department , Malaysia, Putrajaya Malaysia.
- Nemoto, T. 2009, ' Planning framework for international freight transportation infrastructure: A case study on the east-west economic corridor in the greater Mekong subregion.', *The Asian Journal of Shipping and Logistics*, vol. 25, no. 2, pp. 253-271.
- Ng, A. K. 2012, 'Container liner shipping, port development and competition.', in *Maritime Logistics Contemporary Issues*, eds. D.W.Song & P. M. Panayides, Emerald Group Publishing Limited, United Kingdom, pp. 5-28.
- Ng, A.K.Y. and Tongzon, J.L. 2010, The Transportation Sector of India's Economy: Dry Ports as Catalysts for Regional Development, *Eurasian Geography and Economics*, vol.51, no.5, pp.669-82.
- Ng, A. K. & Gujar, G. C. 2009, 'Government policy, efficiency and competitiveness: The case study of Ports in India', *Journal of Transport Policy*, vol. 16, no. 5, pp. 232-239.
- Ng, A. K. Y. & Cetin, B. 2012, 'Locational characteristics of dry ports in developing economies: Some lessons from Northern India', *Journal of Regional Studies*, vol. 46, no. 6, pp. 757-773.

- Ng, A. K. Y., Padilha, F. & Pallis, A. A. 2013, 'Institutions, bureaucratic and logistical roles of dry ports: The Brazilian case', *Journal of Transport Geography*, vol. 27, pp. 46-55.
- Ngah, I. 2010, 'Overview of Regional Development in Malaysia', *Proceedings of the International Conference on Regional Development: Vulnerability, Resilience and Sustainability*, 9-10 November Universitas Diponegoro, Semarang, Indonesia.
- Ngoc, H. D., Nam, K. C. & Quynh, L. N. 2011, 'A consideration for developing a dry port system in Indochina area', *Journal of Maritime Policy & Management*, vol. 38, no. 1, pp. 1-9.
- Nguyen, D. V. H. 2014, 'The development of dry ports in Vietnam.', in, *International Cooperation Department*; Ministry of Transport of Vietnam Vietnam, p. 10.
- Nineth Malaysia Plan 2006, 'Improving infrastructure, utilities and urban transportation', in, Economic planning Unit, Prime Minister Department, Putrajaya, Malaysia, pp. 375-391.
- Notteboom, T. 2000, 'Report of the hundred and thirteen round table of transport economics: Land access to seaport.', *Proceedings of the European Conference of Ministers of Transports, (ECMT)* Paris, pp. 46-75.
- Notteboom, T. 2002, 'Consolidation and contestability in the European container handling industry', *Journal of Maritime Policy & Management*, vol. 29, no. 3, pp. 357-370.
- Notteboom, T. 2004, *Container shipping and ports: an overview*, Institute of Transport and Maritime Management Antwerp (ITMMA), University of Antwerp.
- Notteboom, T. 2005, 'Container shipping and ports: An overview', in, *Review of Network Economics*, pp. 86-106.
- Notteboom, T. 2006, 'The time factor in liner shipping services.', *Maritime Economics and Logistics*, vol. 8, no. 2, pp. 19-39.
- Notteboom, T. 2007, 'Strategic challenges to container ports in a changing market environment', *Journal of Transportation Economics*, vol. 17, no. 4, pp. 29-52.
- Notteboom, T. & Rodrigue, J. 2005, 'Port regionalization: Towards a new phase in port development', *Maritime Policy and Management*, vol. 3, no. 32, pp. 297-313.
- Notteboom, T. & Rodrigue, J. P. 2009, 'Development of dry ports', in *Inland terminals within North American and European supply chains. In East Asia Pacific, Transport and Communications Bulletin for Asia and the Pacific*. United Nations, New York, pp. 1-39.
- Notteboom, T. & Rodrigue, J. P. 2006, 'Challenges in the maritime land interface: Maritime freight and logistics', in, *Report prepared for Korean Government, Ministry of Maritime Affairs & Fisheries*, The Master Development Plan for Port Logistics Park in Korea.

- Notteboom, T. & Yap, W. Y. 2011, 'The interdependence between liner shipping networks and intermodal networks.', *Proceedings of the Annual Conference of the International Association of Maritime Economists*, Santiago, Chile.
- Notteboom, T. E. & Winkelmanns, W. 2001, '"Structural changes in logistics: how will port authorities face the challenge?', *Maritime Policy and Management*, vol. 28, no. 2, pp. 71-89.
- Nulty, D. D. 2008, 'The adequacy of response rates to online and paper surveys: what can be done?', *Assessment & evaluation in higher education*, vol. 33, no. 3, pp. 301-314.
- Nunnally, J. C. & Bernstein, I. H. 1994, 'Exploratory factor analysis II: Rotation and other topics.', *Psychometric Theory*, pp. 491-541.
- Onwuegbuzie, A. J. & Teddlie, C. 2003, *A framework for analysing data in mixed methods research*, SAGE Publications, Los Angeles.
- Onwuegbuzie, A. J. & Collins, K. M. T. 2007, 'A typology of mixed methods sampling design in social science research: ' *The Qualitative Report*, vol. 12, no. 2, pp. 281-316.
- Onwuegbuzie, A. J. & Leech, N. L. 2004, 'Enhancing the interpretation of “significant” findings: The role of mixed methods research', *The Qualitative Report*, vol. 9, no. 4, pp. 770-792.
- Osborne, R. H., Batterham, R.W., Elsworth, G.R., Hawkins, M. and Buchbinder, R., 2013, 'The grounded psychometric development and initial validation of the Health Literacy Questionnaire (HLQ)', *BMC Public Health*, vol. 13, no. 1, pp. 1-17.
- Padgett, D. K. 2009, 'Qualitative and mixed methods in social work knowledge development', *Social Work*, vol. 52, no. 4, pp. 101-105.
- Padilha, P. & A.K.Ng 2012, 'The spatial evolution of dry ports in developing economies. The Brazilian experience', *Journal of Maritime Economics & Logistics*, vol. 14, no. 1, pp. 99-121.
- Paixao, A. C. & Marlow, P. B. 2003, 'Fourth generation ports: A question of agility?', *International Journal of Physical Distribution and Logistics Management*, vol. 33, no. 4, pp. 355-376.
- Pallant, J. 2011, *SPSS survival manual: A step by step guide to data analysis using SPSS*, Allen & Unwin New South Wales.
- Panayides, P. M. 2006, 'Maritime logistics and global supply chains: Towards a research agenda', *Journal of Maritime Economics and Logistics* vol. 8, no. 1, pp. 3-18.
- Panayides, P. M. & Song, D. W. 2009, 'Port integration in global supply chains: Measures and implications for maritime logistics', *International Journal of Logistics Management*, vol. 12, no. 2, pp. 133-145.

- Parker, L. D. & Roffey, B. H. 1997, ' Back to the drawing board: Revisiting grounded theory and the everyday accountant's and manager's reality', *Accounting, Auditing & Accountability Journal*, vol. 10, no. 2, pp. 212-247.
- Pearson, R. 1980, 'Container liner performance and service quality.', in, University of Liverpool and Marine Transport Centre United Kingdom.
- Peters, H. 1990, 'Structural changes in international trade and transport markets: The importance of logistics', *International Association of Ports and Harbors*, vol. 35, no. 9, pp. 58-75.
- Pettit, S.J. and Beresford, A.K.C. 2009, Port Development: From Gateways to Logistics Hubs, *Maritime Policy & Management*, vol.36, no.3, pp. 253–67.
- PKA 2014, 'Port Klang Authority; Malaysian Principle Ports, ' <http://www.pka.gov.my/index.php/en/about-us-/port-klang-authority-/background-.html>, accessed 13th September 2014.
- PLUS 2011, 'PLUS : A global expressway group', <http://www.uem.com.my/images/Brochure/PLUS.pdf>, accessed 6th November 2015.
- Port Authorities Act 2006, 'Laws of malaysia', in, The commissioner of law revision the authority of the revision of laws act 1968, Kuala Lumpur.
- PPC 2014, 'Penang Port Commission:Background of Penang Port Commission', <http://spppisms.blogspot.com.au/>, accessed 14th September 2014.
- PTP 2014, 'Port of Tanjung Pelepas; Provide unrivalled port service globally', <http://www.ptp.com.my/container2.html>, accessed 14th September 2014.
- Punch, K. F. 2006, *Developing effective research proposal*, 2ndedn, SAGE publication Inc., London.
- PWD 2014, 'Public Work Department; Malaysian Highway Authority ', <http://www.kkr.gov.my/ms/node/118>, accessed 16th September 2014.
- Qin, L. Z. 2010a, 'The development the dry ports in China and countermeasure', *Journal of Port Economy*, vol. 9, no. 22, pp. 21-23.
- Qin, Y. 2010b, 'The realisation of seamless trade by means of dry ports construction', *China Business and Trade*, vol. 8, no. 6, pp. 230-231.
- Rafay, I. & Charles, R. 2011, 'Hub location–allocation in intermodal logistic networks', *European Journal of Operational Research*, vol. 210, no. 2, pp. 312-330.
- Rahim, A., Muszafarshah, M. & Farhat, A. 2014, *Danok-Bukit Kayu Hitam, twin border towns on the Thailand-Malaysia's border*, ISEAS Publishing, Institute of South East Asian Studies, Singapore.

- Ravitch, S. M. & Riggan, M. 2012, *Reason and rigor: How conceptual frameworks guide research*, SAGE publication, Los Angeles.
- Reason, P. & Rowan, J. 1981, *Human inquiry. A sourcebook of a new paradigm research*, Chichester, Wiley.
- Regan, A. C. & Golob, T. F. 2005, 'Trucking industry demand for urban shared use freight terminals', *Journal of Transportation* vol. 32, no. 1, pp. 23-36.
- Resnik, D. 2011, 'A troubled tradition it's time to rebuild trust among authors, editors and peer reviewers', *Journal of American Scientist* vol. 99, no. 1, pp. 24-27.
- Richardson, C. A. & Rabiee, F. 2001, 'A question of access: An exploration of the factors influencing the health of young males aged 15-19 living in Corby and their use of health care services.', *Health Education Journal* vol. 60, no. 1, pp. 3-16.
- Riessman, C. 2008, *Narrative methods for the human sciences*, 2ndedn, SAGE publication, London.
- Rimienne, K. & Grundey, D. 2007, 'Logistics centre concept through evolution and definition', *Engineering Economics*, vol. 4, no. 54, pp. 87-95.
- Rimienè, K. & Grundey, D. 2007, 'Logistics centre concept through evolution and definition', *Journal of Engineering Economics*, vol. 4, no. 54, pp. 87-95.
- Rimmer, P. J. 1967, 'The search for spatial regularities in the development of Australian seaports', *Journal of Human Geography: Series B*, vol. 49, no. 1, pp. 42-54.
- Robinson, O. 2014, 'Sampling in interview-based qualitative research: A theoretical and practical guide', *Journal of Qualitative Research in Psychology*, vol. 11, no. 1, pp. 25-41.
- Robinson, R. 2002, 'Ports are elements in value driven chain system: The new paradigm', *Journal of Maritime Policy and Management*, vol. 29, no. 3, pp. 241-255.
- Robles, L. T. 2013, 'The Brazilian seaport system: A post-1990 institutional and economic review.', *Journal of Transportation Business & Management*, vol. 8, pp. 17-29.
- Rodrigue, J. 2008, 'The thruport concept and transmodal rail freight distribution in North America', *Journal of Transport Geography*, vol. 16, pp. 233-246.
- Rodrigue, J. P. 2004, 'Freight, gateways and mega-urban regions: The logistical integration of the Bostwash Corridor 1', *Journal of Economic and Social Geography*, vol. 95, no. 2, pp. 147-161.
- Rodrigue, J. P. 2006, 'Transportation modes', in *The Geography of Transport System*, Taylor & Francis Group, New York.

- Rodrigue, J. P. 2011, 'The functional relations between third party logistics and intermodal transport systems', *Proceedings of the Land Translog Conference*. Puerto Varas, Chile, pp. 86-112.
- Rodrigue, J. P., Comtois, C. & Slack., B. 2006, *The geography of transport systems*, Routledge, New York.
- Rodrigue, J. P., Debie, J., Fremont, A. & Gouveral, E. 2010, 'Functions and actors of inland ports: European and North American dynamics', *Journal of Transport Geography*, vol. 18, no. 9, pp. 519-529.
- Rodrigue, J. P. & Notteboom, T. 2009, 'The terminalization of supply chains: Reassessing the role of terminals in port-hinterland logistical relationships', *Journal of Maritime Policy and Management* vol. 36, no. 2, pp. 165-183.
- Rodrigue, J. P. & Notteboom, T. 2010, 'Foreland-based regionalization: Integrating intermediate hubs with port hinterlands', *Research in Transportation Economics*, vol. 27, no. 1, pp. 19-29.
- Rodrigue, J. P. & Notteboom, T. 2012, 'Dry ports in European and North American intermodal rail systems: Two of a kind?', *Research in Transportation Business & Management*, vol. 5, pp. 4-15.
- Rosa, A. & Roscelli, R. 2009, 'Development of dry ports', in *Transport and Communications Bulletin for Asia and the Pacific*, United Nation, New York.
- Roso, V. 2007, 'Evaluation of the dry port concept from an environmental perspective.', *Transportation Research Part D: Transport and Environment*, vol. 12, no. 7, pp. 523-527.
- Roso, V. 2008, 'Factors influencing implementation of a dry port. ', *International Journal of Physical Distribution and Logistics Management*, vol. 38, no. 10, pp. 782-798.
- Roso, V. & Lumsden, K. 2010, 'A review of dry ports', *Journal of Maritime Economics and Logistics*, vol. 12, no. 2, pp. 196-213.
- Roso, V., Russell, D., Ruamsook, K., & Stefansson, G. 2015, 'Seaport-inland port dyad dynamics: An investigation of service provisions and intermodal transportation linkages', *World Review of Intermodal Transportation Research* vol. 5, no. 3, pp. 263-280.
- Roso, V., Woxenius, J. & Lumsden, K. 2009, 'The dry port concept: Connecting container seaports with the hinterland', *Journal of Transport Geography*, vol. 17, no. 5, pp. 338-345.
- Rovai, A. P., Jason D. Baker, and Michael K. Ponton 2013, *Social science research design and statistics: A practitioner's guide to research methods and IBM- SPSS*, Watertree Press LLC.

- Roza, A., Koting, S. & Karim, M. 2013, 'Intercity land public transport challenges in developing country: A case study in Peninsular Malaysia.', *Proceedings of the Eastern Asia Society for Transportation studies*.
- Rudestam, K. E. & Newton, R. R. 2001, *Surviving your dissertation: A comprehensive guide to content and process*, 2nd edn, Thousand Oaks, SAGE publication, CA.
- Rudner, L. M. 2001, 'Informed test component weighting', *Educational measurement: Issues and practice*, vol. 20, no. 1, pp. 16-19.
- Rusli, M. 2012, 'Navigational hazards in international maritime chokepoints : A study of the Straits of Malacca and Singapore', *Journal of International Studies* vol. 8, no. 47, pp. 1-35.
- Ryan, G. W. & Bernard, H. R. 2003, 'Techniques to identify themes', *Field Methods* vol. 15, no. 1, pp. 85-109.
- Salant, P. & Dillman, D. A. 1994, *How to conduct your own survey*, John Wiley & Sons, New York.
- Salisbury, M. 2014, 'Top 50 World Container Ports-2013', <http://www.joc.com/port-news/top-50-world-container-ports-2013.html>; *Journal of Commerce*, accessed 14th September 2014.
- Sanchez, R. J. & Tuchel, N. 2005, *Port development: A circular accumulation process*, Elsevier, Amsterdam, the Netherlands.
- Sanchez, R. J. & Wilmsmeier, G. 2010, *Contextual port development: A theoretical approach*, Phisica-Verlag, London Yew York.
- San Antonio Port Company 2014, 'Chilean port system', in, Dresdner Kleinwort Benson: South Andes Ltd., p. 110.
- Saunders, M., Lewis, P. & Thornhill, A. 2009, *Research methods for business students*, 5thedn, Financial Times Prentice Hall, London.
- Sekaran, U. & Bougie, R. 2010, *Research methods for business: A skill-building approach*, 5thedn, Southern Gate, Chichester, John Wiley & Sons, Inc.
- Shahryari, M. & Ibrahim, H. M. 2009, 'Cross traffic movement and its risk to shipping in the straits of Malacca', in, Maritime Institute of Malaysia (MIMA), Kuala Lumpur, Malaysia, pp. 2-6.
- Shepherd, D. C. & Helms, M. M. 1995, 'Total quality management measures: Reliability and validity issues', *Industrial Management* vol. 37, no. 4, pp. 16-21.
- Shi, L. 2009, 'Analysis on the strategies of Tianjin's dry port construction ', *Journal of Logistics Sci-Tech*, vol. 10, pp. 19-21.

- Shirley, C. & Winston, C. 2004, 'Firm inventory behavior and the returns from highway infrastructure investments', *Journal of Urban Economics*, vol. 55, no. 2, pp. 398-415.
- Shu, C., Zhou, K. Z., Xiao, Y., & Gao, S 2015, 'How green management influences product innovation in China: The role of institutional benefits', *Journal of Business Ethics*, pp. 1-15.
- Simatupang, T. M. & Sridharan, R. 2002, 'The collaborative supply chain', *The International Journal of Logistics Management*, vol. 13, no. 1, pp. 15-30.
- Simsek, Z. & Veiga, J. F. 2001, 'A primer on internet organizational surveys', *Organizational Research Method*, vol. 4, no. 3, pp. 218-235.
- SIP 2015, 'Segamat Inland Port: Products and services', <http://transportation.zibb.com/profile/segamat+inland+port+sdn+bhd/my/johor/segamat/85000/26338785>, accessed 18th April 2015.
- Slack, B. 1985, 'Containerization inter-port competition and port selection.', *Journal of Maritime Policy and Management* vol. 12, no. 4, pp. 293-303.
- Slack, B. 1999, 'Shipping lines and their influence on port development. The dock and harbour authority', in, pp. 23-30.
- Smith, R. A. 2003, 'Railways: How they may contribute to a sustainable future', *Journal of Rail and Rapid Transit Part F*, vol. 217, no. 4, pp. 243-248.
- Song, D. W. 2003, 'Port co-operation in concept and practice.', *Journal of Maritime Policy and Management* vol. 30, no. 1, pp. 29-44.
- Song, D. W. & Panayides, P. M. 2008, 'Global supply chain and port-terminal: Integration and competitiveness.', *Journal of Maritime Policy & Management*, vol. 35, no. 1, pp. 73-78.
- Song, D. W. & Yeo, G. T. 2004, 'A competitive analysis of Chinese container ports using the analytic hierarchy process.', *Journal of Maritime Economics & Logistics*, vol. 6, no. 1, pp. 34-52.
- Soon, C. & Lam, W. H. 2013, 'The growth of seaports in Peninsular Malaysia and East Malaysia for 2007-2011', *Ocean & Coastal Management*, vol. 78, pp. 70-76.
- Sparke, M., Sidaway, J. D., Bunnell, T. & Warr, G. 2004, 'Triangulating the borderless world: geographies of power in the Indonesia–Malaysia–Singapore growth triangle', *Transactions of the Institute of British Geographers*, vol. 29, no. 4, pp. 485-498.
- Stanton, N., McIlroy, R., Harvey, C. & Ryan, B. 2013, 'Following the cognitive work analysis train of thought: exploring the constraints of modal shift to rail transport.', *Journal of Ergonomics*, vol. 56, no. 3, pp. 522-540.

- Starr, J. 1994, 'The mid-Atlantic load centre: Baltimore or Hampton Road?', *Journal of Maritime Policy and Management* vol. 21, no. 3, pp. 219-227.
- Storper, M. 1997, 'The Port of Baltimore: Off the beaten track?', *Journal of Maritime Policy and Management*, vol. 18, no. 171-181.
- Strauss, A. & Corbin, J. 1997, *Grounded theory methodology*, Thousand Oaks: SAGE publication, London.
- Strauss, A. & Corbin, J. 1998, *Basic of qualitative research: Techniques and procedures for developing grounded theory*, 2ndedn, Thousand Oaks, CA: SAGE publication, USA.
- Stuart, I., McCutcheon, D., Handfield, R., McLachlin, R. & Samson, D. 2002, 'Effective case research in operations management: A process perspective', *Journal of Operations Management* vol. 20, no. 5, pp. 419-433.
- Sue, V. M. & Ritter, L. A. 2012, *Conducting online surveys*, SAGE publication, Thousand Oaks.
- Suffian, F., Rosline, A. K. & Shah, M. R. 2013, *The cabotage policy: Is it still relevant in Malaysia?*, Springer, Selangor, Malaysia.
- Suhr, D. & Shay, M. 2009, 'Guidelines for reliability, confirmatory and exploratory factor analysis', *Proceedings of the Western Users of SAS Conference* San Jose, CA.
- Suhr, D. 2006, 'Exploratory or confirmatory factor analysis?', *Proceedings of the SUGI 31*, San Francisco.
- Sukdanot, S., Rudjanakanoknad, J. & Suksirivoraboot, W. 2013, 'Development of Thai International Ports in accordance with ASEAN Economic Community', *Proceedings of the Eastern Asia Society for Transportation Studies*, Taipei.
- Sulaiman, N. A., Husain, F., Hashim, K. A., & Samad, A. M. 2012, 'A study on flood risk assessment for Bandar Segamat sustainability using remote sensing and GIS approach.', *Proceedings of the International Control and System Graduate Research Colloquium* 16-17 July 2012, Universiti Teknologi MARA (UiTM) Shah Alam, Selangor, Malaysia.
- Sullivan, F. 2011, 'Feasibility study for Padang Besar Inland Clearance Depot', in *Transportation & Logistics Practice Asia Pacific*, Northern region economic corridor Kuala Lumpur, Malaysia, pp. 2-200.
- Taaffe, E. J. 1963, 'Transport expansion in underdeveloped countries: A comparative analysis', *Journal of Geographical Review*, vol. 53, no. 12, pp. 503-529.
- Tabachnick, B. G. & Fidell, L. S. 2000, *Using multivariate statistics*, 4thedn, Harper Collins, New York.

- Taib, A. K. 2011, 'Country Report of Malaysia', in *The current status of gis implementation in Malaysia*, Department of Survey and Mapping Malaysia, Seoul, Republic of Korea.
- Talley, W. K. 2011, 'The blackwell companion to maritime economics', *Maritime Economics and Logistics*, vol. 8, pp. 10-13.
- Taneja, P., Zwakhals, J. W. & Vellinga, T. 2013, 'Mega Vessels and Quay Walls', *Proceedings of Ports '13th Triennial International Conference*, Seattle, Washington.
- Tashakkori, A. & Creswell, J. 2007, 'Exploring the nature of research questions in mixed methods research', *Journal of Mixed Method Research*, vol. 1, no. 3, pp. 207-211.
- Tashakkori, A. & Teddlie, C. 2003, 'Issues and dilemmas in teaching research methods courses in social and behavioral sciences: US perspective', *International Journal of Social Research Methodology* vol. 6, no. 1, pp. 61-77.
- Tashakkori, A. & Teddlie, C. 2010, "Putting the human back in ‘Human research methodology’: The researcher in mixed methods research." ', *Journal of Mixed Methods Research*, vol. 4, no. 4, pp. 271-277.
- Taylor, J. 2000, 'Reassessing discretionary fiscal policy', *The Journal of Economic Perspectives*, vol. 21, no. 36, pp. 999-1006.
- Teddlie, C., & Yu, F 2007, 'Mixed methods sampling a typology with examples.', *Journal of Mixed Methods Research*, vol. 1, no. 1, pp. 77-100.
- Teddlie, C. & Tashakkori, A. 2003, *Major issues and controversies in the use of mixed method in social and behavioral science*, SAGE Publications, Thousand Oaks, CA.
- Teddlie, C. & Tashakkori, A. 2009, *Foundation of mixed methods research*, SAGE publications, Thousand Oaks, CA.
- Teddlie, C. & Tashakkori, A. 2006, 'A general typology of research designs featuring mixed methods', *Research in the Schools*, vol. 13, no. 1, pp. 12-28.
- Tengku, A. M. 1995, *Marketing of freight liner shipping services with reference to the far-East-Europe trade: A Malaysian perspective*, Ph.D thesis, University of Wales. College of Cardiff., United Kingdom.
- TenthMalaysiaPlan 2011, 'Creates new environment for unleashing economic growth', in *Economic development cluster*, Economy planning unit, Prime Minister's Department, Malaysia., Putrajaya, Malaysia, pp. 119-124.
- Thomas, B. 1957, 'Railways and ports in French West Africa', *Journal of Economic Geography*, vol. 33, no. 1, pp. 1-15.
- Tongzon, J. 2009, 'Port choice and freight forwarders.', *Transportation Research Part E: Logistics and Transportation Review*, vol. 45, no. 1, pp. 186-195.

- Trainaviciute, L. 2009, 'The dry port: Concept and perspectives', in, eds. K. Bentzen, M. S. Laugesen & A. Caruso., *Association of Danish Transport and Logistics Centres Denmark*.
- Tsilingris, P. S. 2007, 'Dry vis-a-vis water ports: Partners or competitors? The case of Spain', *Proceedings of the Competitiveness And Complementarity Of Transport Modes: Perspectives for the development of intermodal transport*, University Of The Aegean., pp. 10-13.
- Tull, M. & Reveley, J. 2002, 'Privatisation of ports: An evaluation of the Malaysian experience.', *A Journal of Applied Economics and Policy*, vol. 21, no. 4, pp. 63-79.
- Turner, D. W. 2010, 'Qualitative interview design: A practical guide for novice investigators', *The Qualitative Report*, vol. 15, no. 3, pp. 754-760.
- Tutty, L. M. 1996, 'Post-shelter services: The efficacy of follow-up programs for abused women', *Research on Social Work Practice*, vol. 6, no. 4, pp. 425-441.
- UNCTAD 1982, 'Multimodal transportation and containerisation part 5: Ports and container depots.', in, *United Nation, Conference on Trade and Development, Geneva*, pp. 67-98.
- UNCTAD 1991, 'Handbook on the management and operation of dry ports', in *Conference on Trade and Development*, United Nations, Geneva, pp. 256-298.
- UNCTAD 1992, 'Port marketing and the challenge of the third generation port', in, *United Nation*, Geneva, pp. 358-361.
- UNCTAD 2010, 'Review of maritime transport', in *Port and multimodal transport development*, ed. UNCTAD. secretariat, UNITED NATIONS Geneva.
- UNCTAD 2013, 'Review of Maritime Transport', in *Port developments*, eds. H.Finkenbrink, R. Piller & J. W. Vanhoogenhuizen, United Nations, New York and Geneva, pp. 88-94.
- UNCTAD 2015, 'Developments in international seaborne trade', in *Review of Maritime Transport*, ed. J. Hoffmann, United Nations, Geneva, pp. 2-21.
- UNECE 1998, 'UN/LOCODE - Code for ports and other locations and recommendation', in, *United Nations, Economic Commission for Europe*, Geneva., pp. 48-59.
- UNECE 2001, 'Terminology of combined transport', in *European Conference of Ministers of Transport (ECMT) and the European Commission (EU)*, United Nation., New York. united Stated, pp. 114-131.
- UNESCAP 2006, 'Logistics sector developments: Planning models for enterprises and logistics clusters.', in, *United Nation Economic and Social Commission for Asia and the Pacific*, pp. 13-21.

- UNESCAP 2008, 'Improvement of transport and logistics facilities to expand port hinterlands: Policy guidelines.', in, *United Nations*, New York., pp. 301-330.
- UNESCAP 2009, 'Review of Developments in Transport in Asia and the Pacific.', in, *Economic and Social Commission for Asia and the Pacific*, New York. United States, pp. 60-84.
- UNESCAP 2010, 'The development of dry ports along the Asian Highway and Trans-Asian Railway networks.', in, *United Nation Economic and Social Commission for Asia and the Pacific*, New York, pp. 201-220.
- UNESCAP 2012, 'Development of an integrated transport and logistics system in ASEAN countries and the Pacific Subregion. Introduction to the development of dry ports in Asia ', in, *United Nation*, Bangkok, Thailand, pp. 321-344.
- UNESCAP 2013, 'Trans-Asian Railway', <http://www.unescap.org/our-work/transport/trans-asian-railway/>; *United Nations Economic and Social Commission for Asia and the Pacific* accessed 18th September 2014.
- UNESCAP 2014, 'Capacity-building for the development and operation of dry ports of international importance', in *Intergovernmental agreement on dry ports*, United Nation, Bangkok.
- UNESCAP & KMI 2007, ' Logistic sector development: Planning models for enterprises and logistic clusters', in, *United Nations*, New York & Korean Maritime Institute, pp. 234-271.
- UTAS 2011, 'Research: Integrity and ethics, The University of Tasmania', <http://www.utas.edu.au/research/integrity/-and-ethics>, accessed 10th September 2014.
- Valautham, A. 2007, 'Container Transportation by Railways; The development of container landbridge train services between Malaysia and Thailand', *Transport and Communications Bulletin for Asia and the Pacific*, no. 77.
- Valentine, F. & Gray, R. 2001, 'The measurement of port efficiency using data envelopment analysis', *Proceedings of the 9th World Conference on Transport Research*, South Korea: Seoul.
- Vause, J. 2006, 'Quality versus value', *New Zealand Medical Journal*, vol. 119, no. 1238, p. U2095.
- Veenstra, A., Zuidwijk, R. and Van Asperen, E. 2012a, 'The extended gate concept for container terminals: Expanding the notion of dry ports.', *Maritime Economics & Logistics*, vol. 14, no. 1, pp. 14-32.
- Veenstra, A., Zuidwijk, A. R. & Asperen, E. 2012b, 'Perceived benefits of improvement information exchange: a case study on rail and intermodal transports ', *Journal of Transport Economics*, vol. 6, no. 14, pp. 14-32.

- Verhoeven, P. 2010, 'A review of port authority functions: Towards a renaissance?', *Maritime Policy & Management*, vol. 37, no. 3, pp. 247-270.
- Vernimmen, B., Dullaert, W. & Engelen, S. 2007, 'Schedule unreliability in liner shipping: Origins and consequences for the hinterland supply chain,' *Journal of Maritime Economics & Logistics*, vol. 9, no. 10, pp. 193-213.
- Vervest, P. & Li, Z. 2009, 'The emergence of smart business networks', *Journal of Information Technology*, vol. 19, no. 4, pp. 228-233.
- Visser, J. 2006, 'Urban freight transport policies and planning in Europe: An overview and classification of policy measures. ', in, *Research Institute for Housing, Urban and Mobility Studies*. Delft University of Technology, Netherlands, pp. 56-78.
- Visser, J., Konings, R., Pielage, B. J. & Wiegmans, B. 2009, 'A new hinterland transport concept for the port Rotterdam: Organisational or technological challenges?', *Journal of Transportation Research*, vol. 4, no. 3, pp. 201-216.
- Wan, Y., Zhang, A. & Yuen, A. C. 2013, 'Urban road congestion, capacity expansion and port competition: Empirical analysis of US container ports', *Maritime policy and Management Science*, vol. 40, no. 5, pp. 417-438.
- Wang, G. 2009, 'Research on inland dry ports construction and development mode.', *Journal of Port Economy*, vol. 3, no. 3, pp. 27-30.
- Weigend, G. 1956, 'The problem of hinterland and foreland as illustrated by the port of Hamburg. ', *Journal of Economic Geography*, vol. 32, no. 1, pp. 1-16.
- Weisbrod, R. E., Swiger, E., Muller, G., Rugg, F. M. & Murphy, M. K. 2002, 'Global freight villages: A solution to the urban freight dilemma.', *Proceedings of the Transportation Research Board Annual Meeting*, France.
- Werikhe, G. W., & Jin, Z. 2015, 'A comparative study of dry ports in East Africa and China. ', *Developing Country Studies*, vol. 5, no. 2, pp. 7-17.
- Wiegmans, B., Hoest, A. & Notteboom, T. 2008, 'Port and terminal selection by deep sea container operators', *Journal of Maritime Policy and Management*, vol. 35, no. 6, pp. 517-534.
- Wiegmans, B., Masurel, E. & Nijkamp, P. 1999, 'Intermodal freight terminals: An analysis of the terminal market', *Journal of Transportation Planning and Technology*, vol. 23, no. 2, pp. 105-128.
- Wilkinson, M. J. & Thornton, J. G. 1999, 'When is a research gift an inducement?', *Bulletin of Medical Ethics*, vol. No. 151, p. 2.
- Williams, B., Onsman, A. and Brown, T. 2010, 'Australian paramedic graduate attributes: A pilot study using exploratory factor analysis.', *Emergency Medicine Journal*, vol. 27, no. 10, pp. 794-799.

- Willingale, M. 1981, 'The port routing behavior of short sea ship operator theory and practices.', *Journal of Maritime Policy and Management*, vol. 8, no. 2, pp. 109-120.
- Wilmsmeier, G. & Monios, J. 2013, 'Counterbalancing peripherality and concentration: An analysis of the UK container port system', *Maritime Policy & Management*, vol. 40, no. 2, pp. 116-132.
- Wilmsmeier, G. & Zarzoso, I. M. 2010, 'Determinants of maritime transport costs: A panel data analysis for Latin American trade.', *Journal of Transportation Planning and Technology*, vol. 33, no. 1, pp. 105-121.
- Wisetjindawat, W., Sano, K., Matsumoto, S. & Raothanachonkun, P. 2007, 'Micro-simulation model for modeling freight agents interactions in urban freight movement.', *Proceedings of the In CD Proceedings, 86th Annual Meeting of the Transportation Research Board*, Washington DC.
- Wong, C., Lai, K. H. & Teo, T. 2009, 'Institutional pressure and mindful IT management: The case of container terminal in China', *Journal of Information and Management*, vol. 46, pp. 434-441.
- Wong, K.H., Shou, E.C., Zhang, H. and Ng, A.K., 2016. Strategy formulation of new generation ports: A case study of the Hong Kong International Terminals Ltd.(HIT). *Research in Transportation Business & Management*.
- Woo, S. H., Bang, H. S., Martin, S. & Li, K. X. 2013, 'Evolution of research themes in maritime policy and management', *Maritime Policy and Management*, vol. 40, no. 3, pp. 200-225.
- Woodburn, A. 2011, 'An investigation of container train service provision and load factors in Great Britain', *European Journal of Transport and Infrastructure Research*, vol. 2, no. 11, pp. 147-165.
- World Bank 2006, 'Port reform toolkit ', in *Effective decision support policy markets and practitioners, Module 3*, The world bank group, public-private infrastructure advisory facility, Washington, pp. 1-20.
- Woxenius, J., Roso, V. & Lumsden, K. 2004, 'The dry port concept—connecting seaports with their hinterland by rail', *Proceedings of the ICLSP Conference Proceedings*, 22-26 September 2004, Dalian, Department of Transportation and Logistics Chalmers University of Technology.
- Woxenius, J. & Bergqvist, R. 2010, 'Hinterland transport by train: Comparing the Scandinavian conditions for maritime containers and semi-trailers', *Journal of Transport Geography*, vol. 8, no. 4, pp. 125-136.
- Woxenius, J. & Bergqvist, R. 2011, 'Comparing maritime containers and semi-trailers in the context of hinterland transport by rail', *Journal of Transport Geography* vol. 19, no. 4, pp. 680-688.

- Yang, D., Zhang, A. & Lam, J. S. L. 2013, 'Impacts of port productivity and service level on liner shipping operating cost and schedule reliability', in *International Forum on Shipping, Ports and Airports (IFSPA) 2013: Trade, Supply Chain Activities and Transport: Contemporary Logistics and Maritime Issues*.
- Yang, J., Li, K. & Wang, W. Y. 2014, 'Competition, cooperation and dynamic governance of Chinese port clusters – the perspective from liner shipping companies', *Proceedings of the International Association of Maritime Economists*, July 15-18, Norfolk VA, USA.
- Yeo, G. T., Roe, M. & Dinwoodie, J. 2008, 'Evaluating the competitiveness of container ports in Korea and China', *Journal of Transportation Research: Part A*, vol. 42, no. 9, pp. 910-921.
- Yin, R. K. 2014, *Case study research: Design and methods*, SAGE publication, Thousand Oak, California.
- Zanni, A. M. & Bristow, A. L. 2009, 'Emissions of carbon dioxide from road freight transport in London: Trends and policies for long run reductions', *Journal of Energy and Policy*, vol. 38, no. 4, pp. 1774-1786.
- Zawawi, N. F. M., Wahab, S.A., Yaacob, A.S., Samy, N.K.A. and Fazal, S.A., 2016, 'Measuring the effectiveness of road transportation logistics performance in East Malaysia: A conceptual model', *International Journal of Business and Management*, vol. 11, no. 4, pp. 110-120.
- Zikmund, W. G., Babin, B. J., Carr, J. C. & Griffin, M. 2010, *Business research methods*, 8th edn, South-Western Cengage Learning, Mason, USA.
- Zou, Y. 2009, 'Discussion on dry ports development in China', *Journal of Water Transportation Management* vol. 12, no. 2, pp. 18-24.

APPENDIX: A

Interview Questionnaire

Research title: The Role of Malaysian Dry Ports in the Container Seaport System.

PART A. Role of dry ports in seaport systems

- A1. How the dry port roles are **defined** in Malaysia?
- A2. What are the **objectives** of the development of Malaysian dry ports?
- A3. What are the main **functions** of Malaysian dry ports?
- A4. Who are the main **users** of Malaysian dry ports?
- A5. Do you think that seaports and their stakeholders **benefit** from the **assistance of dry ports** in managing cargo transported to and from seaports in terms of **time and cost**?
- A6. What are the **infrastructure/personnel requirements** for dry port operation?

PART B. The challenges, opportunities and strategies for dry port development

- B1. Why do you think that Malaysian dry ports have **strengths/or constraints** in managing cargo transported to and from seaports?
- B2. What do you think are the major **challenges** facing dry ports?
- B3. Based on the challenges mentioned in B2, what do you think are the best **strategies** for improving dry port operations in the seaport system?
- B4. What are the **opportunities** of dry ports in Malaysia for further development?

PART C. Influencing operating factors of dry ports

- C1. What are the factors that **influence** dry port operations?
- C2. What are the **impacts** of dry ports on seaport competitiveness?

THE ROLE OF MALAYSIAN DRY PORTS IN THE CONTAINER SEAPORT SYSTEM

CONSENT FORM (For Interview)

This consent form is for interview participants from Malaysian dry ports operators, container seaport authorities, container seaport operators and government bodies.

1. I agree to take part in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves me taking part in a face-to-face interview which will take about 30-40 minutes. My answers may be recorded with my consent and permission.
I agree to have the interview voice recorded. Yes ☐ No ☐
5. I understand that there are no specific risks anticipated with participation in this study.
6. I understand that all research data will be kept in a locked cabinet in the office of the researcher at the University of Tasmania in Australia for five years from the date of first publication, and will then be destroyed.
7. Any questions that I have asked have been answered to my satisfaction.
8. I understand that the researcher will maintain confidentiality and that any information I supply to the researcher will be used only for the purposes of the research.
9. I understand that the results of the study will be published so that I cannot be identified as a participant.
10. I understand that my participation is voluntary and that I may withdraw at any time without any effect. If I so wish, until 15 March 2016, I may request that any data I have supplied be withdrawn from the research.

Participant's name: _____

Participant's signature: _____

Date: _____

Statement by Investigator

I have explained the project and the implications of participation to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation. ☐

If the Investigator has not had an opportunity to talk to participants prior to them participating, the following must be ticked.

The participant has received the Information Sheet where my details have been provided so participants have had the opportunity to contact me prior to consenting to participate in this project. ☐

Investigator's name: _____

Investigator's signature: _____

Date: _____

THE ROLE OF MALAYSIAN DRY PORTS IN THE CONTAINER SEAPORT SYSTEM

PARTICIPANT INFORMATION SHEET (For Interview)

This information sheet is for participants from Malaysian dry ports operators, container seaports authorities, container seaport operators and government bodies.

Invitation

You are invited to participate in a research project exploring the significant role of dry ports in the container seaport system to enhance the seaport's competitiveness. The study is being conducted in partial fulfillment of a PhD degree for Jagan Jeevan under the supervision of Dr. Shu-Ling Chen and Dr. Eon-Seong Lee from the Department of Maritime and Logistics Management, Australian Maritime College, University of Tasmania.

What is the purpose of this study?

The purpose of this research is to investigate how dry ports development in Malaysia can enhance the competitiveness of container seaport systems. It aims to review current management and operation of Malaysia container seaport system, examine the strength, constrain and opportunities of Malaysian dry port operation, identify the factors influencing Malaysian dry port operations, examine the challenges encountered by the existing dry ports and finally recommend effective strategies for improving the dry ports operations.

Why have I been invited to participate?

You are invited to participate in this research because you are one of the key professional actors with extensive management experience and knowledge in the container seaport system in Malaysia.

What will I be asked to do?

This study needs your participation to provide your valuable views regarding the specific information on the roles, challenges of dry ports in the container seaport system development strategies of dry ports in Malaysia. The participation in this interview will take approximately 30-40 minutes. In order to ensure the accuracy rather than risk of faulty interpretation or memory, your answers may be audio recorded with your consent and permission. The interview recordings will not be used for any other purpose except for transcribing comments. Please be assured in this respect that all responses will only be used for research purposes with strict confidentiality and will not be attributed to any particular person.

Are there any possible benefits from participation in this study?

This research will identify the roles and challenges of Malaysian dry ports in the container port system. It will provide a clear guidance to Malaysian dry ports on improving their services, future development as main logistics centres and intermodal terminals, and increasing their capability to replicate the function of seaports in the inland. Additionally, this research will generate a new dimension on seaport development strategy by prioritising the development of dry ports in Malaysia. It is very crucial for seaports to create a strong network with dry ports as it will not only benefit the region development where dry ports are located but help to promote the competitiveness of seaports in the maritime industry.

Are there any possible risks from participation in this study?

There are no specific risks anticipated with participation in this study.

What if I change my mind during or after the study?

It is important that you understand that your involvement in this study is voluntary. While we would be pleased to have you participate, we respect your right to decline. There will be no consequences to you if you decide not to participate, and this will not affect your treatment / service. If you decide to discontinue participation at any time, you may do so without providing an explanation. You may also, if you so wish, at this time, ask that any data you have provided to date be removed from the study.

What will happen to the information when this study is over?

Data will be kept on paper documents and stored within a locked filing cabinet in a locked office within the National Centre of Port and Shipping, Department of Maritime Logistics and Management, Australian Maritime College at the University of Tasmania. All files (electronic and paper based) will be held for a maximum of 5 years following the publication of reports or articles resulting from data generation and then securely destroyed.

All information will be treated in a confidential manner, and your name will not be used in any publication arising out of the research. In the final report, you will be referred to by a numeric pseudonym.

How will the results of the study be published?

This study constitutes the source of primary information and data for the student investigator's doctoral thesis. The findings may later be presented or published at conferences and in other academic arenas, including journals. Copies of such publications can be supplied upon request to any participant in the study.

What if I have questions about this study?

If you would like to discuss any aspect of this study please feel free to contact the student investigator or chief investigator/co-investigator:

CHIEF INVESTIGATOR:

Dr. Shu-Ling Chen, Lecturer
Department of Maritime and Logistics
Management, Ph: +61363249694
Email: pchen@amc.edu.au

CO-INVESTIGATOR:

Dr. Eon Seong Lee
Department of Maritime and Logistics
Management, Ph: +61363249882
Email: e.lee@amc.edu.au

STUDENT INVESTIGATOR:

Jagan Jeevan, PhD Candidate
Department of Maritime and Logistics
Management, Ph: +61497362053
Email: jjeevan@amc.edu.au

This study has been approved by the Tasmanian Social Science Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study should contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number [].

Thank you for taking the time to consider this study.
If you wish to take part in it, please sign the attached consent form.
This information sheet is for you to keep.

APPENDIX: B

Q: A1. How are the dry port roles **defined** in Malaysia?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response (%)
Interview participants					
1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> Assistance for seaports in supply chain Seaport competitiveness and competencies Transportation development Logistic and supply chain provider Generate container volume Enhance seaport performance 	<ul style="list-style-type: none"> Generate container volume Seaport function inland Seaport competitiveness Time and cost advantage Logistic and supply chain 	<ul style="list-style-type: none"> Facilitator in supply chain 11(100) Providing space for laden and empty containers 9(82) Simplifies seaport activities inland 7(64) 	<i>Extended seaport</i>	11(100)
1, 2, 3, 4, 6, 7, 8, 9 & 11	<ul style="list-style-type: none"> Transit port connecting various domestic or international business parks Regional base port located inland Intensify domestic economy Transit centre from seaport to final destination Regional economic centre Inland logistic entity 	<ul style="list-style-type: none"> Regional centric Container transshipment centre inland Inland logistic entity 	<ul style="list-style-type: none"> Regional centric 9(82) Inland transshipment terminal 8(73) Inland terminals 7(64) 	<i>Regional intermodal node</i>	9(82)
1, 2, 3, 4, 5, 6, 7 & 8	<ul style="list-style-type: none"> Same entity as seaports located between ports and manufacturer Transit terminal for small and medium industry Multimodalism Connecting station Additional facility for manufacturer 	<ul style="list-style-type: none"> Multimodal transport system Interface between seaport and other stakeholders Connecting station 	<ul style="list-style-type: none"> Interface for various modes of transportation8(73) Interface between seaports and manufacturers 6(55) 	<i>Interface terminal</i>	8(73)
Definitions of Malaysian dry ports: (3 themes)					

Q: A2. What are the **objectives** of the development of Malaysian dry ports?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response (%)
Interview participants					
1, 2, 3, 4, 5, 6, 7, 9, 10 & 11	<ul style="list-style-type: none"> • Enhancing domestic trade • Improving international trade 	<ul style="list-style-type: none"> • Improving cross-border transactions • Improving intra-regional transactions 	<ul style="list-style-type: none"> • Improving inter/intra national trade activities 	<i>Accelerating national and international business</i>	10(91)
1, 2, 4, 5, 6, 7, 9, 10 & 11	<ul style="list-style-type: none"> • Developing intermodal systems in container transportation • Fast, accurate and timely delivery 	<ul style="list-style-type: none"> • Synchronisation between various modes of transportation • Implementation of modal split/shift 	<ul style="list-style-type: none"> • Improving intermodal systems in container transportation systems 	<i>Activating intermodalism in the nation</i>	9(82)
1, 2, 4, 8, 9, 10 & 11	<ul style="list-style-type: none"> • Improving seaport efficiency & effectiveness • Reducing traffic congestion in main seaports • Providing additional space for accumulated containers 	<ul style="list-style-type: none"> • Enhancing seaport competitiveness • Improving seaport performance 	<ul style="list-style-type: none"> • Improving the attractiveness of Malaysian container seaports 	<i>Improving seaport competitiveness</i>	7(64)
1, 2, 3, 4, 5, 8 & 11	<ul style="list-style-type: none"> • De/consolidation centre for states which has no container seaports • Improving the development of national economic 	<ul style="list-style-type: none"> • Market for job opportunities • Balancing regional development • Improving transportation connectivity 	<ul style="list-style-type: none"> • Enhancing economic status in peninsular Malaysia 	<i>Enhancing regional economic development</i>	7(64)
1, 3, 5, 7, 8 & 9	<ul style="list-style-type: none"> • Improving seaport facilities • Utilising seaport facilities • Enhancing seaport operation • Multiply ancillary services in seaports • Improving hinterland transportation 	<ul style="list-style-type: none"> • Developing seaports, hinterland connectivity and their intermodal facilities • Supporting cabotage policy 	<ul style="list-style-type: none"> • Improving nation's seaport policy 	<i>Establishing Malaysian port policy</i>	6(55)
Objectives of Malaysian dry ports: (5 themes)					

Q: A3. What are the main **functions** of Malaysian dry ports?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response rate
Interview participants					
1, 3, 4, 5, 6, 7, 8, 9, 10 & 11	<ul style="list-style-type: none">• Transshipment function• Container transportation function	<ul style="list-style-type: none">• Inland transshipment centre• Container distribution/pick up	<ul style="list-style-type: none">• Container transportation	<i>Transport function</i>	<i>10(91)</i>
1, 2, 3, 4, 6, 8 & 11	<ul style="list-style-type: none">• Customs clearance function• Immigration function• Security function• Express clearance function	<ul style="list-style-type: none">• Various documentation clearances services at different locations	<ul style="list-style-type: none">• Documentation clearances	<i>Administration function</i>	<i>7(64)</i>
1, 4, 5, 7 & 8	<ul style="list-style-type: none">• Warehouse function• Storage function• Domestic trade• De/consolidation function• Container service management• Distriparks function• Barter trade ports function	<ul style="list-style-type: none">• Warehouse, storage	<ul style="list-style-type: none">• Inland warehouse	<i>Logistic function</i>	<i>5(45)</i>
1, 4, 5, 6 & 9	<ul style="list-style-type: none">• Value adding function	<ul style="list-style-type: none">• Product customisation/value adding centre	<ul style="list-style-type: none">• Value adding centre for seaport	<i>Value adding function</i>	<i>5(45)</i>
Functions of Malaysian dry ports: (4 themes)					

Q: A4. Who are the main **users** of Malaysian dry ports?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response rate
Interview participants					
1, 2, 4, 5, 6, 7, 8, 9 & 10	• Brokers • Freight forwarders	• Freight forwarders	• Freight forwarders	<i>Freight forwarders</i>	9(82)
1, 3, 4, 5, 6, 7 & 8	• Shippers	• Shippers	• Shippers	<i>Shippers</i>	7(64)
1, 4, 5, 6, 7 & 8	• Rail operator	• Rail operator	• Rail operator	<i>Malaysian railway</i>	6(55)
1, 3, 4, 5 & 6	• Ports	• Ports	• Ports	<i>Seaports</i>	5(45)
2, 3, 7, 8 & 9	• Truck operators	• Hauliers	• Hauliers	<i>Hauliers</i>	5(45)
8, 9 & 11	• International & national companies	• International & national manufacturers	• International & national manufacturers	<i>International and domestic manufacturers</i>	3(27)
Main users of Malaysian dry ports: (6 themes)					

Q: A5. What are the **benefits** of dry ports to seaports and other stakeholders?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response rate
Interview participants					
1, 2, 4, 5, 6, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> Reducing unnecessary waiting time at seaport Improving vessel turnaround time 	<ul style="list-style-type: none"> Less waiting time for various stakeholders and seaport users 	<ul style="list-style-type: none"> Less waiting time for ships and trucks 	<i>Reducing waiting times at seaports</i>	10(91)
1, 3, 4, 5, 6, 7, 8, 9 & 10	<ul style="list-style-type: none"> Reducing clearance activities at seaport to improve the operation at seaport 	<ul style="list-style-type: none"> Less documentation procedure at seaports which reduces time consumption 	<ul style="list-style-type: none"> Avoiding long customs clearance times at seaports 	<i>Providing clearance systems</i>	9(82)
2, 3, 5, 6, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> Reducing inland transport cost Reducing the market price of the cargo at the destination Increasing the utilisation of rail facilities for container transportation 	<ul style="list-style-type: none"> Reducing container transportation cost inland 	<ul style="list-style-type: none"> Reducing transportation costs 	<i>Reducing freight costs</i>	9(82)
1, 2, 6, 8, 9, 10 & 11	<ul style="list-style-type: none"> Improving cross-border transactions (Thailand-Malaysia-Singapore) Increasing perishable commodities from Thailand to Malaysian seaports 	<ul style="list-style-type: none"> Increasing container volume in Malaysian seaports 	<ul style="list-style-type: none"> Easing inter-regional trade between nations 	<i>Facilitating cross-border transactions</i>	7(64)
3, 5, 6, 8 & 10	<ul style="list-style-type: none"> Reducing container turnaround time Improving the connectivity from seaport-dry port-hinterland 	<ul style="list-style-type: none"> Fast container movement from one port to another 	<ul style="list-style-type: none"> Balancing laden & empty container transportation 	<i>Reducing empty container movements</i>	5(45)
Benefits of Malaysian dry ports: (5 themes)					

Q: A6. What are the **infrastructure/personnel requirements** for dry port operations?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response rate
Interview participants					
1, 2, 4, 5, 6, 7, 8, 9, 10 & 11	Container yard, customs, rail and truck access, rail siding, express clearance lane, customs, immigration & quarantine office, weigh bridge, truck parking bay, internal roads, cargo consolidation yard, external and internal road accessibility, stacker cranes, warehouse, stuffing and unstuffing yards, empty container and repair yards, physical checking yard, police station, fire station security office and cafeteria	<ul style="list-style-type: none"> • Basic operational requirement • All these operational requirements are divided into 4 main categories 	<ul style="list-style-type: none"> • Primary requisites 10(91) • Important requisites 6(55) • Miscellaneous requisites 5(45) 	<i>Operational infrastructure requirements</i>	10(91)
1, 3, 4, 5, 6, 7, 8, 9 & 11	Skilled personnel to operate warehouses, container yard, stuffing and unstuffing, consolidation, container repairs, operate express clearance lane, truck parking bay managers and stacker crane operators	<ul style="list-style-type: none"> • Personnel to handle warehouse, yard and for safety and security 	<ul style="list-style-type: none"> • Warehouse staff 9(82) • Yard staff 6(55) • Safety and security staff 5(45) 	<i>Personnel requirements</i>	9(82)
1, 2, 3, 5, 7, 8, 9 & 10	Weigh bridge, rail access tracks, rail siding, internal roads and external roads	<ul style="list-style-type: none"> • Basic transport infrastructure requirement 	<ul style="list-style-type: none"> • Transportation infrastructure 8(73) 	<i>Capital infrastructure requirements</i>	8(73)
Requirements for Malaysian dry ports: (3 themes)					

Q: B1. What do you think are the **strengths** of Malaysian dry ports?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response rate
Interview participants					
1, 2, 3, 5, 6, 7 & 11	<ul style="list-style-type: none">• Provide logistical connections to origins/ destination as far north as Bangkok and Singapore in the south• Promote cross-border transactions between Malaysia and Singapore	<ul style="list-style-type: none">• Provide seaport facilities and services to local and international manufacturers/stakeholders• Fast container transactions at the borders with red-tape procedures	<ul style="list-style-type: none">• Support Thailand-Malaysia-Singapore trade• Promote cross-border transactions	<i>Strategic location</i>	7(64)
1, 2, 3, 4, 6 & 8	<ul style="list-style-type: none">• Involvement of private and government sector in dry port operations	<ul style="list-style-type: none">• Seaports, private sector and railway	<ul style="list-style-type: none">• PPP	<i>Public-private partnership</i>	6(55)
1, 2, 3, 4, 9 & 11	<ul style="list-style-type: none">• Time advantage (6hrs LKICD to PBCT and 9 hrs. from LKICD to LCP)	<ul style="list-style-type: none">• Fast container transportation• Low dwelling time (3 hrs dwelling time in Penang port and 7 hrs in LCP)	<ul style="list-style-type: none">• Reducing container dwelling time at seaport	<i>Transport connectivity</i>	6(55)
Strengths of Malaysian dry ports: (3 themes)					

Q: B2. What do you think are the major **challenges** facing dry ports?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response (%)
Interview participants					
1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> • Low capacity of train transportation • Less application of multimodal transportation • No wide road access • No railway connection for particular dry ports 	<ul style="list-style-type: none"> • Insufficient railway track 11(100) • Low frequency of train movement 9(82) • Low capacity of train decks to carry a high volume of containers 9(82) • High inbound volume of cross border containers, but inefficient container transfer system to seaports 6(55) • Less participation of local haulages for short distance shipments 5(45) • Single mode transportation 5(45) • Dry ports without rail link 5(45) 	<ul style="list-style-type: none"> • Lack of transportation infrastructure 	Transportation infrastructure and operation	11(100)
1, 2, 5, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> • Inefficient container transfer operations to seaports • Frequent delays when transferring containers between transport modes 	<ul style="list-style-type: none"> • Unorganised containers on the rail deck 8(73) • Delays in container relocating process 8(73) • No space for empty containers 8(73) • Disintegration of container planning in rail deck affecting seaport performance 7(64) 	<ul style="list-style-type: none"> • Ineffective container planning system 	Container planning	8(73)
2, 3, 4, 6, 8 & 11	<ul style="list-style-type: none"> • Seaports expecting dry ports to be all-rounder by providing maximum value adding services with sufficient facilities 	<ul style="list-style-type: none"> • A lack of cooperation/recognition from seaports to utilise the dry port's capability 6(55) • Unable to be all-rounder 6(55) • Low volume at dry ports 6(55) • Competition with shipping lines 6(55) • Competition between private hauliers 4(36) 	<ul style="list-style-type: none"> • Competition with various competitors 	Competition	6(55)
1, 4, 5, 7, 8 & 9	<ul style="list-style-type: none"> • The location of dry port is less strategic and economic • Less potential for land expansion 	<ul style="list-style-type: none"> • Located in the non-profitable/strategic zone 6(55) • Limited space for development 4(36) • Distance from manufacturing zone 4(36) 	<ul style="list-style-type: none"> • Less profitable location 	Location	6(55)
2, 3, 5, 8 & 9	<ul style="list-style-type: none"> • The delayed upgrade on infrastructure in regional cities/towns • High infrastructure pressure especially roads in the cities/towns 	<ul style="list-style-type: none"> • Infrastructure exhaustion/pressure 5(45) • Delay in infrastructure upgrading process 5(45) • Noise and air pollution generated by road transportation 5(45) • Traffic congestion in some regional areas 4(36) • Lack of exposure/awareness of dry ports' credibility to the stakeholders 4(36) 	<ul style="list-style-type: none"> • Social issues 	Community	5(45)
Challenges of Malaysian dry ports: (5 themes)					

Q: B3. What do you think are the best **strategies** for improving dry port operations in the seaport system?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding
Interview participants				
1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> • Implementation of double track system • Providing haulier services by dry ports • Implementation of modal shift 	<ul style="list-style-type: none"> • Rail system optimisation • Transport coordination for short distance 	<ul style="list-style-type: none"> • Introducing double track rails 11(100) • Providing options for east coast Malaysian freight transportation 7(64) • Encourage modal shift by increasing rail transport 5(45) • Providing haulier service through vertical integration 5(45) 	<i>Strategies for transportation infrastructure and operation</i>
1, 4, 5, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> • Adequate space in dry ports • Systematic container management/planning on railway deck 	<ul style="list-style-type: none"> • Equal proportion in freight transportation • Adequate information sharing 	<ul style="list-style-type: none"> • Information sharing for planning container distribution 8(73) 	<i>Strategies for container planning</i>
1, 2, 3, 4, 6, 8 & 9	<ul style="list-style-type: none"> • Instigate investment strategy • Cooperation between seaport-dry port 	<ul style="list-style-type: none"> • All-rounder dry ports • Function transformation in dry ports • Range of value adding services 	<ul style="list-style-type: none"> • Enhancing the capability of dry ports 7(64) • Cooperation between seaports and dry ports 7(64) 	<i>Strategies for competition</i>
1, 4, 5, 7, 8 & 9	<ul style="list-style-type: none"> • Location shifting strategy • Cooperation with other intermodal terminals for 'space sharing' 	<ul style="list-style-type: none"> • Network integration between dry ports to improve the connectivity 	<ul style="list-style-type: none"> • Enhancing multimodal transportation 6(55) • Providing different services 5(45) 	<i>Strategies for location</i>
2, 3, 5, 9 & 10	<ul style="list-style-type: none"> • Transformation barter trade ports as dry ports • Dry ports alternative for seaport reclamation 	<ul style="list-style-type: none"> • Balancing transportation options to reduce infrastructure pressure 	<ul style="list-style-type: none"> • Involvement of dry ports in the barter trade 5(45) • Freight transportation development 4(36) 	<i>Strategies for community</i>
Strategies for improving dry port operations in the seaport: (5 themes)				

Q: B4. What are the **opportunities** of dry ports in Malaysia for further development?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response (%)
Interview participants					
1, 2, 4, 5, 6, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> • Optimisation of Malaysia-Thailand Landbridge, SKRL, TAR • Reduce distance • Increase connectivity • Enhance the intermodalism 	<ul style="list-style-type: none"> • Boosting intra- and inter-regional transportation development 	<ul style="list-style-type: none"> • Potential for fast container delivery and pick-up from various regions • Potential for equal improvement in rail and road transportation 	<i>Accessibility to international transport networks</i>	10(91)
1, 2, 6, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> • Strategic location of dry ports • Optimisation of national development plan 	<ul style="list-style-type: none"> • Location of dry ports are scattered from northern to southern peninsular Malaysia • Increasing the connectivity between seaports and stakeholders via dry ports 	<ul style="list-style-type: none"> • Potential for balanced regional development in peninsular Malaysia 	<i>Government's international and national economic development plans</i>	8(73)
Opportunities for Malaysian dry ports' further development: (2 themes)					

Q: C1. What are the factors that **influence dry ports operations**?

Stages of Analysis	Familiarisation and Reflection	Open Coding	Axial Coding	Selective Coding	Response (%)
Interview participants					
1, 2, 3, 4, 5, 6, 7, 8, 9, 10 & 11	<ul style="list-style-type: none"> • Space for laden and empty containers • Range of value adding services • Documentation procedures • Container repairing services 	<ul style="list-style-type: none"> • Value adding services 11(100) • Customs clearance 10(91) • Storage services 9(82) • Maintenance 8(73) 	<ul style="list-style-type: none"> • Range of services 	<i>Services features</i>	<i>11(100)</i>
1, 2, 3, 4, 5, 6, 7, 8, 9 & 10	<ul style="list-style-type: none"> • Transport facilities • Space 	<ul style="list-style-type: none"> • Infrastructure and facilities 10(91) • Space 8(73) 	<ul style="list-style-type: none"> • Capacity to replicate seaports' function 	<i>Capacity</i>	<i>10(91)</i>
1, 2, 3, 4, 5, 6, 7, 8 & 9	<ul style="list-style-type: none"> • Near to manufacturing area • High access to main seaports • High frequency of rail access • Access to manufacturing area • High quality of road access 	<ul style="list-style-type: none"> • Location 9(82) • Transport connectivity 9(82) 	<ul style="list-style-type: none"> • Connection between seaports and hinterland 	<i>Hinterland condition</i>	<i>9(82)</i>
2, 3, 4, 5, 6, 7 & 8	<ul style="list-style-type: none"> • Information sharing 	<ul style="list-style-type: none"> • Coordination 7(64) • Information collaboration 6(55) 	<ul style="list-style-type: none"> • Information sharing between stakeholders 	<i>Information sharing</i>	<i>7(64)</i>
4, 5, 6, 7 & 8	<ul style="list-style-type: none"> • Government policy 	<ul style="list-style-type: none"> • Cabotage policy 5(45) • Seaport policy 3(27) 	<ul style="list-style-type: none"> • Coastal shipping development • Intermodal development 	<i>Government policy</i>	<i>5(45)</i>
<i>Influencing factors of dry ports operations: (5 themes)</i>					

Q: C2. What are the **impacts** of dry ports on seaport competitiveness?

Stages of Analysis	Familiarisation and reflection	Open Coding	Axial Coding	Selective Coding	Response (%)
Interview participants					
1, 2, 3, 4, 5, 6, 7, 10 & 11	<ul style="list-style-type: none"> • Seaport-dry port connectivity • Transportation connectivity 	<ul style="list-style-type: none"> • Seaport-dry port accessibility 9(82) • Seaport-dry port-hinterland connectivity 8(73) • Improving multimodalism 7(64) • Cross-border connectivity 5(45) 	<ul style="list-style-type: none"> • Improving seaport connectivity 	<i>Seaport hinterland proximity</i>	9(82)
1, 2, 3, 4, 6, 7, 8 & 9	<ul style="list-style-type: none"> • High performance • Space availability • Operational speed • High efficiency • Easy to switch and redistribute 	<ul style="list-style-type: none"> • Confidence in seaport schedule 8(73) • Low dwelling time 6(55) • High ship-call frequency 6(55) • Low logistic charges 5(45) 	<ul style="list-style-type: none"> • Improving seaport operation 	<i>Seaport performance</i>	8(73)
1, 2, 3, 4, 5, 6, 7 & 8	<ul style="list-style-type: none"> • Space for laden and empty containers • Additional facilities availability 	<ul style="list-style-type: none"> • High space availability 8(73) • Additional facilities for seaports 8(73) 	<ul style="list-style-type: none"> • Improving seaport in container handling capacity 	<i>Seaport capacity</i>	8(73)
2, 3, 4, 5, 7, 8 & 11	<ul style="list-style-type: none"> • Improve container delivery and pick up from market • Support the development of domestic & international markets 	<ul style="list-style-type: none"> • Continuity in container volume 7(64) 	<ul style="list-style-type: none"> • Improving national and international trade 	<i>Seaport trade</i>	7(64)
Impacts of dry ports on seaport competitiveness: (4 themes)					

THE ROLE OF MALAYSIAN DRY PORTS IN THE CONTAINER SEAPORT SYSTEM

PARTICIPANT INFORMATION SHEET (For online survey)

Invitation

You are invited to take part in a research project entitled “**The Role of Malaysian Dry Ports in the Container Seaport System**”. The study is being conducted in partial fulfillment of a PhD for Jagan Jeevan under the supervision of Dr. Peggy Chen and Dr. Eon Seong-Lee from the Department of Maritime Logistics and Management, Australian Maritime College, University of Tasmania.

What is the purpose of this study?

The purpose of this study is to analyse the factors influencing Malaysian dry ports operations and evaluates the impact of dry ports on container seaports competitiveness.

Why have I been invited to participate?

You are invited to participate in this study because you are one of the main stakeholders in Malaysian container seaport system.

What does this study involve?

This study needs your participation by completing an online survey that examines your views on the operating factors that determine dry ports operations in the container seaport system. The online survey via Questionpro will take only 15 minutes of your time to complete. If you wish to take part in the study, simply click on the web link indicated in the email and complete the questionnaire. Receiving your completed questionnaire implies your consent for participating in this survey.

It is important that you understand that your involvement in this study is voluntary. While we would be pleased to have you participate, we respect your right to decline. There will be no consequences to you if you decide not to participate, and this will not affect your treatment / service. If you decide to discontinue participation at any time, you may do so without providing an explanation. You may also, if you so wish, at this time, ask that any data you have provided to date be removed from the study. All information will be treated in a confidential manner, and your name will not be used in any publication arising out of the research. In the final

report, you will be referred to by a numeric pseudonym. All of the research will be kept in a locked cabinet in the office of the Department of Maritime and Logistics Management and will be destroyed at least five years after the data has been published.

Are there any possible benefits from participation in this study?

This study will reveal the influencing factors of dry ports operations vital to enhance the seaport competitiveness in Malaysian container seaports system. It generates a new dimension on seaports development strategy by prioritising the development of dry ports in Malaysia. This section is very crucial to seaport to move simultaneously with the development in the containerisation and create a healthy network between dry ports and seaports. The revelations would single out the contributions of dry ports to the region and help promote the well-being of seaports in the maritime industry.

Are there any possible risks from participation in this study?

There are no specific risks anticipated with participation in this study.

What will happen to the information when this study is over?

Data will also be kept on paper documents and stored within a locked filing cabinet in a locked office within the National Centre of Port and Shipping, Department of Maritime Logistics Management, Australian Maritime College at the University of Tasmania. All files (electronic and paper based) will be held for a maximum of 5 years following the publication of reports or articles resulting from data generation and then securely destroyed.

How will the results of the study be published?

This study constitutes the source of primary information and data for the student investigator's doctoral thesis. The findings may later be presented or published at conferences and in other academic arenas, including journals. Copies of such publications can be supplied upon request to any participant in the study.

What if I have questions about this study?

If you would like to discuss any aspect of this study please feel free to contact the student investigator or chief investigator/co-investigator:

CHIEF INVESTIGATOR:

Dr. Peggy Chen, Senior Lecturer
Department of Maritime and Logistics
Management, Ph: +61363249694
Email: pchen@utas.edu.au

CO-INVESTIGATOR:

Dr. Eon Seong-Lee, Lecturer
Department of Maritime and Logistics
Management, Ph: +61363249882
Email: e.lee@utas.edu.au

STUDENT INVESTIGATOR:

Jeevan Jagan, PhD Candidate
Department of Maritime and Logistics
Management, Ph: +61497362053
Email: jjeevan@utas.edu.au

This study has been approved by the Tasmanian Social Science Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study should contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number (H0013659).

**Thank you for taking the time to consider this study.
This information sheet is for you to keep.**

APPENDIX: C

Selamat Sejahtera / Greetings:

You are invited to participate in our survey entitled THE ROLE OF MALAYSIAN DRY PORTS IN THE CONTAINER SEAPORT SYSTEM. This study is being conducted in partial fulfilment of a PhD for Jagan Jeevan from the Department of Maritime Logistics and Management, Australian Maritime College, University of Tasmania. This survey will take approximately 15 minutes and your participation in this study is completely voluntary. For further questions please contact: jjeevan@utas.edu.au. Thank you very much for your time and support. Please start with the survey now by clicking on the Continue button below.

SECTION A: RESPONDENT/ORGANISATION PROFILE

A1. Please indicate your position in the current organisation

- ☐ Director
- ☐ Chief Executive Officer
- ☐ Advisor
- ☐ Manager
- ☐ Executive
- ☐ Coordinator
- ☐ Other

A2. Please indicate the nature of your organisation.

- ☐ Freight forwarder
- ☐ Haulier
- ☐ Shipping line
- ☐ Railway operator
- ☐ Seaport
- ☐ Shipper
- ☐ Other

A3. How long have you have been in your current position?

- ☐ 0-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ Over 16 years
- ☐ Other

A4. How frequently does your organisation use the following container seaports in your daily operations?

	Extremely frequently	Very frequently	Moderately frequently	Slightly frequently	Not at all	N/A
A4.1 Penang Port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.2 Port Klang (West Port & North Port)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.3 Port of Tanjung Pelepas (PTP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.4 Johor Port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.5 Kuantan Port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.6 Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A5. How frequently does your organisation use the following dry ports in your daily operations?

	Extremely frequently	Very frequently	Moderately frequently	Slightly frequently	Not at all	N/A
A5.1 Ipoh Cargo Terminal (ICT)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A5.2 Nilai Inland Port (NIP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A5.3 Padang Besar Cargo Terminal (PBCT)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A5.4 Segamat Inland Port (SIP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A5.6 Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION B: INFLUENCING FACTORS ON DRY PORTS OPERATIONS

How important are the following for influencing Malaysian dry ports operations?

	Extremely important	Very important	Moderately important	Slightly important	Not important	N/A
B1. Located near to a border, seaport or industrial zone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2. Road connectivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B3. Rail connectivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B4. Cooperation with seaport	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B5. Container storage service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B6. Value adding services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B7. Rail-truck transfer service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B8. Container maintenance services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B9. Customs, immigration and police inspection services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B10. Sufficient equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B11. Modern and sophisticated equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B12. Well maintained equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B13. Adequate highways and wide roads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B14. Adequate railway tracks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B15. Sufficient space for containers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B16. Space utilisation via collaboration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B17. Coordination for risk sharing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B18. Coordination for facility utilisation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B19. Providing information for accurate decision making	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B20. Information of container flow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

forecasting						
B21. Public ownership	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B22. Private ownership	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B23. Public & Private investment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B24. Cabotage policy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B25. Multimodal transport infrastructure development policy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B26. Seaport policy (land side transportation)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION C: IMPACT OF DRY PORTS ON SEAPORT COMPETITIVENESS

To what extent do you agree that the following impacts on container seaport competitiveness are caused by dry ports?

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree	N/A
C1. Increase ship call frequency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C2. Increase seaport reliability (stability of service quality)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C3. Increase seaport efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C4. Reduce inland distribution costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C5. Increase berth productivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C6. Expand seaport-hinterland transport networks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C7. Improve seaport hinterland access	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C8. Increase accessibility to and from seaports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C9. Improve seaport-hinterland connectivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C10. Provide additional space for seaports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C11. Provide additional facilities for seaports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C12. Increase continuity of containers to seaports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C13. Increase volume of containers for inland transshipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C14. Increase the supplementary services for seaports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C15. Shift value adding services of seaports to inland	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C16. Support seaport flexibility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION D: OTHERS

Please click your estimates of the total container traffic (TEUs) recorded in your organisation in 2014 and the near future.

	0-100 TEUs	101-200 TEUs	201-500 TEUs	501- 1,000 TEUs	1,001- 4,000 TEUs	4,001- 9,999 TEUs	Over 10,000 TEUs	N/A
D1-2014	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D2- 2017	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D3-2020	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How important are the following modes of transportation for inland container distribution in Peninsular Malaysia?

	Extremely important	Very important	Moderately important	Slightly important	Not important	N/A
D2.1 Road transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D2.2 Rail transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX: D

Social Science Ethics Officer
Private Bag 01 Hobart
Tasmania 7001 Australia
Tel: (03) 6226 2763
Fax: (03) 6226 7148
Katherine.Shaw@utas.edu.au



HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

21 November 2013

Dr Peggy Chen
National Centre for Ports and Shipping
Australian Maritime College
Locked Bag 1397

Student Researcher: Jagan Jeevan

Sent via email

Dear Dr Chen

Re: MINIMAL RISK ETHICS APPLICATION APPROVAL
Ethics Ref: H0013659 - **The Role of Malaysian Dry Ports in the Container Seaport System**

We are pleased to advise that acting on a mandate from the Tasmania Social Sciences HREC, the Chair of the committee considered and approved the above project on 19 November 2013.

This approval constitutes ethical clearance by the Tasmania Social Sciences Human Research Ethics Committee. The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approval of other bodies or authorities is required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

Please note that this approval is for four years and is conditional upon receipt of an annual Progress Report. Ethics approval for this project will lapse if a Progress Report is not submitted.

The following conditions apply to this approval. Failure to abide by these conditions may result in suspension or discontinuation of approval.

1. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval, to ensure the project is conducted as approved by the Ethics

A PARTNERSHIP PROGRAM IN CONJUNCTION WITH THE DEPARTMENT OF HEALTH AND HUMAN SERVICES

Committee, and to notify the Committee if any investigators are added to, or cease involvement with, the project.

2. Complaints: If any complaints are received or ethical issues arise during the course of the project, investigators should advise the Executive Officer of the Ethics Committee on 03 6226 7479 or human.ethics@utas.edu.au.
3. Incidents or adverse effects: Investigators should notify the Ethics Committee immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
4. Amendments to Project: Modifications to the project must not proceed until approval is obtained from the Ethics Committee. Please submit an Amendment Form (available on our website) to notify the Ethics Committee of the proposed modifications.
5. Annual Report: Continued approval for this project is dependent on the submission of a Progress Report by the anniversary date of your approval. You will be sent a courtesy reminder closer to this date. **Failure to submit a Progress Report will mean that ethics approval for this project will lapse.**
6. Final Report: A Final Report and a copy of any published material arising from the project, either in full or abstract, must be provided at the end of the project.

Yours sincerely

Katherine Shaw
Ethics Officer
Tasmania Social Sciences HREC

A PARTNERSHIP PROGRAM IN CONJUNCTION WITH THE DEPARTMENT OF HEALTH AND HUMAN SERVICES

Social Science Ethics Officer
Private Bag 01 Hobart
Tasmania 7001 Australia
Tel: (03) 6226 2763
Fax: (03) 6226 7148
Human.ethics@utas.edu.au



HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

26 November 2014

Dr Shu-Ling Chen
National Centre for Ports and Shipping
Australian Maritime College
Locked Bag 1397

Sent via email

Dear Dr Chen

Re: APPROVAL FOR AMENDMENT TO CURRENT PROJECT
Ethics Ref: H0013659 - The Role of Malaysian Dry Ports in the Container Seaport
System

- Addition of online survey.
- Information sheet for survey.

We are pleased to advise that the Chair of the Tasmania Social Sciences Human
Research Ethics Committee approved the Amendment to the above project on 24
November 2014.

Yours sincerely

Katherine Shaw
Executive Officer
Tasmania Social Sciences HREC

APPENDIX: E

E.1 Descriptive statistics of the items (Section B)

Descriptive Statistics								
	N	Mean		Std. Deviation	Skewness		Kurtosis	
		Mean	Std. Error			Std. Error		Std. Error
Located near to border, seaport or industrial zone	120	4.58	4.62	.495	-.342	.221	-1.915	.438
Road connectivity	120	4.52	4.57	.635	-1.165	.221	1.206	.438
Rail connectivity	120	4.42	4.48	.669	-.746	.221	-.532	.438
Cooperation with seaports	120	4.17	4.24	.833	-1.032	.221	1.295	.438
Container storage services	120	4.34	4.40	.680	-.548	.221	-.743	.438
Value adding services	120	4.42	4.48	.706	-1.113	.221	1.003	.438
Rail-truck transfer services	120	4.39	4.45	.759	-1.266	.221	1.460	.438
Container maintenance services	120	4.40	4.46	.691	-.877	.221	.203	.438
Customs immigration and police inspections services	120	4.81	4.84	.395	-1.587	.221	.526	.438
Sufficient equipment	120	4.32	4.36	.661	-.449	.221	-.725	.438
Modern and sophisticated equipment	120	4.27	4.33	.742	-.600	.221	-.507	.438
Well maintained equipment	120	4.35	4.41	.718	-.636	.221	-.824	.438
Adequate highways and wide roads	120	4.41	4.47	.716	-.789	.221	-.655	.438
Adequate railway tracks	120	4.32	4.38	.710	-.544	.221	-.865	.438
Sufficient space for containers	120	4.27	4.33	.673	-.560	.221	.014	.438
Space utilisation via collaboration	120	4.23	4.29	.730	-.657	.221	.057	.438
Coordination for risk sharing	120	4.18	4.26	.904	-.702	.221	-.626	.438
Coordination for facility utilisation	120	4.23	4.30	.864	-.772	.221	-.415	.438
Providing information for accurate decision making	120	4.07	4.15	.936	-.713	.221	-.156	.438
Information of container flow forecasting	120	4.11	4.19	.877	-.518	.221	-.806	.438
Public ownership	120	3.83	3.93	1.103	-.504	.221	-.930	.438
Private ownership	120	3.77	3.87	1.121	-.473	.221	-.869	.438
Public-private investment	120	4.21	4.28	.849	-.834	.221	-.047	.438
Cabotage policy	120	4.26	4.23	.835	-1.047	.221	.612	.438
Multimodal transport infrastructure development policy	120	4.34	4.41	.783	-1.220	.221	1.339	.438
Seaport policy (land side transportation)	120	4.29	4.36	.814	-1.061	.221	.672	.438

E.2 Descriptive statistics of the items (Section C)

	N	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	5% trimmed mean	Statistic	Statistic	Std. Error	Statistic	Std. Error
Increase ship call frequency	120	4.42	4.47	.630	-1.015	.221	1.910	.438
Increase seaport reliability (stability and quality of service)	120	4.32	4.38	.712	-.851	.221	.505	.438
Increase seaport efficiency	120	4.24	4.30	.756	-.673	.221	-.164	.438
Reduce inland distribution costs	120	4.37	4.43	.697	-.947	.221	.819	.438
Increase berth productivity	120	4.27	4.33	.658	-.344	.221	-.731	.438
Expand seaport hinterland transport networks	120	4.48	4.52	.518	-.083	.221	-1.574	.438
Improve seaport hinterland access	120	4.23	4.32	1.075	-1.843	.221	2.967	.438
Increase accessibility to and from seaports	120	4.44	4.48	.531	-.105	.221	-1.260	.438
Improve seaport hinterland connectivity	120	4.43	4.47	.530	-.073	.221	-1.260	.438
Provide additional space for seaports	120	4.40	4.45	.571	-.286	.221	-.777	.438
Provide additional facilities for seaports	120	4.41	4.46	.587	-.397	.221	-.695	.438
Increase continuity of containers to seaports	120	4.28	4.34	.688	-.594	.221	-.094	.438
Increase volume of containers for inland transshipment	120	4.16	4.23	.789	-1.022	.221	1.196	.438
Increasing supplementary services for seaports	120	4.28	4.34	.663	-.388	.221	-.749	.438
Shifting value adding services of seaports to inland	120	4.23	4.29	.719	-.381	.221	-.990	.438
Support seaport flexibility	120	4.26	4.32	.667	-.349	.221	-.769	.438

E.3. Container seaports and dry ports used by respondents

Container seaport	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Penang Port	3.86	1.025	-.621	.227	-.490	.451
Port Klang	4.12	.988	-.906	.225	-.238	.446
Port of Tanjung Pelepas	3.83	1.008	-.549	.226	-.518	.447
Johor Port	3.01	1.328	.180	.234	-1.261	.463
Kuantan Port	2.12	.878	.301	.238	-.707	.472
Dry ports	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Ipoh Cargo Terminal	3.77	1.227	-.913	.224	-.123	.444
Nilai Inland Port	3.63	1.158	-.709	.226	-.194	.447
Padang Besar Cargo Terminal	3.32	1.361	-.200	.226	-1.184	.447
Segamat Inland Port	3.04	1.134	.213	.228	-.650	.453

E.4. Estimated throughput trend among dry port users 2014-2020

Container TEUs in 2014	Mean	Frequency	Percent	Valid Percent
0-100 TEUs	3.83	6	5.0	5.0
101-200 TEUs		27	22.5	22.5
201-500 TEUs		14	11.7	11.7
501-1000 TEUs		31	25.8	25.8
1001-4000 TEUs		27	22.5	22.5
4001-9999 TEUs		6	5.0	5.0
Over 10000 TEUs		9	7.5	7.5
Total		120	100.0	100.0
Expected TEUs in 2017		Frequency	Percent	Valid Percent
0-100 TEUs	4.60	2	1.7	1.7
101-200 TEUs		8	6.7	6.7
201-500 TEUs		23	19.2	19.2
501-1000 TEUs		14	11.7	11.7
1001-4000 TEUs		39	32.5	32.5
4001-9999 TEUs		24	20.0	20.0
Over 10000 TEUs		10	8.3	8.3
Total		120	100.0	100.0
Expected TEUs in 2020		Frequency	Percent	Valid Percent
0-100 TEUs	5.42	2	1.7	1.7
101-200 TEUs		1	.8	.8
201-500 TEUs		7	5.8	5.8
501-1000 TEUs		23	19.2	19.2
1001-4000 TEUs		19	15.8	15.8
4001-9999 TEUs		38	31.7	31.7
Over 10000 TEUs		30	25.0	25.0
Total		120	100.0	100.0

E.5. Importance of transportation mode for container transportation

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Important of road transportation	120	4.60	.556	-1.002	.221	.004	.438
Important of rail transportation	120	4.24	1.202	-1.600	.221	1.496	.438

E.6 Communalities initial run PCA extraction (Section B)

	Initial	Extraction
Located near to border, seaport or industrial zone	1.000	0.773
Road connectivity	1.000	0.691
Rail connectivity	1.000	0.773
Cooperation with seaports	1.000	0.608
Container storage services	1.000	0.658
Value adding services	1.000	0.814
Rail-truck transfer services	1.000	0.758
Container maintenance services	1.000	0.764
Customs immigration and police inspections services	1.000	0.839
Sufficient equipment	1.000	0.771
Modern and sophisticated equipment	1.000	0.773
Well maintained equipment	1.000	0.779
Adequate highways and wide roads	1.000	0.767
Adequate railway tracks	1.000	0.773
Sufficient space for containers	1.000	0.656
Space utilisation via collaboration	1.000	0.631
Coordination for risk sharing	1.000	0.743
Coordination for facility utilisation	1.000	0.884
Providing information for accurate decision making	1.000	0.886
Information of container flow forecasting	1.000	0.813
Public ownership	1.000	0.773
Private ownership	1.000	0.799
Public-private investment	1.000	0.710
Cabotage policy	1.000	0.764
Multimodal transport infrastructure development policy	1.000	0.882
Seaport policy (land side transportation)	1.000	0.850
Extraction Method: Principal Component Analysis.		

E.7 Communalities initial run PCA extraction (Section C)

	Initial	Extraction
Increase ship call frequency	1.000	0.546
Increase seaport reliability (stability and quality of service)	1.000	0.656
Increase seaport efficiency	1.000	0.788
Reduce inland distribution costs	1.000	0.756
Increase berth productivity	1.000	0.647
Expand seaport hinterland transport networks	1.000	0.640
Improve seaport hinterland access	1.000	0.501
Increase accessibility to and from seaports	1.000	0.807
Improve seaport hinterland connectivity	1.000	0.743
Provide additional space for seaports	1.000	0.808
Provide additional facilities for seaports	1.000	0.763
Increase continuity of containers to seaports	1.000	0.862
Increase volume of containers for inland transshipment	1.000	0.879
Increasing supplementary services for seaports	1.000	0.818
Shifting value adding services of seaports to inland	1.000	0.879
Support seaport flexibility	1.000	0.804
Extraction Method: Principal Component Analysis.		

E.8. Multiple regression results

Dependent Variable: Seaport performance						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.508 ^a	.258	.211	.88799463		
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.684	7	4.383	5.559	.000 ^b
	Residual	88.316	112	.789		
	Total	119.000	119			
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.469E-16	.081		.000	1.000
	Capacity	.072	.081	.072	.882	.380
	Information sharing	.262	.081	.262	3.214	.002
	Service features	.121	.081	.121	1.483	.141
	Government policy	.144	.081	.144	1.772	.079
	hinterland condition	.316	.081	.316	3.882	.000
	Location	.220	.081	.220	2.703	.008
	Administration	.024	.081	.024	.291	.772

a. Dependent Variable: Variation in seaport services						
Model	R	R Square	Adjusted R Square		Std. Error of the Estimate	
1	.429 ^a	.184	.133		.93110945	
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	21.900	7	3.129	3.609	.002 ^b
	Residual	97.100	112	.867		
	Total	119.000	119			
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	-1.117E-17	.085		.000	1.000
	Capacity	.194	.085	.194	2.277	.025
	Information sharing	.082	.085	.082	.961	.339
	Service features	.171	.085	.171	1.999	.048
	Government policy	.318	.085	.318	3.722	.000
	hinterland condition	.019	.085	.019	.226	.821
	Location	-.081	.085	-.081	-.943	.348
	Administration	-.052	.085	-.052	-.604	.547

a. Dependent Variable: Seaport hinterland proximity						
Model	R	R Square	Adjusted R Square		Std. Error of the Estimate	
1	.343 ^a	.117	.062		.96833409	
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.981	7	1.997	2.130	.046 ^b
	Residual	105.019	112	.938		
	Total	119.000	119			
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	2.963E-16	.088		.000	1.000
	Capacity	.135	.089	.135	1.524	.130
	Information sharing	.072	.089	.072	.808	.421
	Service features	.181	.089	.181	2.036	.044
	Government policy	.088	.089	.088	.994	.322
	hinterland condition	-.056	.089	-.056	-.627	.532
	Location	.059	.089	.059	1.793	.376
	Administration	.159	.089	.159	1.787	.029

a. Dependent Variable: Seaport trade volume						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.180 ^a	.033	-.028	1.01388753		
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.868	7	.553	.537	.804 ^b
	Residual	115.132	112	1.028		
	Total	119.000	119			
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	-9.677E-17	.093		.000	1.000
	Capacity	.040	.093	.040	.429	.669
	Information sharing	-.015	.093	-.015	-.158	.875
	Service features	-.122	.093	-.122	1.312	.192
	Government policy	.058	.093	.058	.629	.531
	hinterland condition	.025	.093	.025	.268	.789
	Location	.084	.093	.084	.901	.370
	Administration	-.069	.093	-.069	-.744	.458

a. Dependent Variable: Seaport capacity						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.222 ^a	.049	-.010	1.00517015		
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.839	7	.834	.826	.568 ^b
	Residual	113.161	112	1.010		
	Total	119.000	119			
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-5.434E-16	.092		.000	1.000
	Capacity	.102	.092	.102	1.112	.268
	Information sharing	.152	.092	.152	1.654	.101
	Service features	.077	.092	.077	.832	.407
	Government policy	.075	.092	.075	.818	.415
	hinterland condition	-.002	.092	-.002	-.019	.985
	Location	-.040	.092	-.040	-.430	.668
	Administration	.047	.092	.047	.511	.611

APPENDIX: F

Paper 1: The development of Malaysian dry ports in the container seaport system

Jagan Jeevan, Shu-Ling Chen, and Eon-Seong Lee

**Department of Maritime and Logistics Management, Australian Maritime College,
University of Tasmania, Launceston, Australia.**

**Proceedings of the 2014 International Association of Maritime, Economists
(IAME) Conference, 15-18 July 2014, Norfolk, Virginia, USA.**

**This article has been
removed for copyright
or proprietary reasons.**

Paper 2: The challenges of Malaysian dry ports development

Jagan Jeevan, Shu-Ling Chen, and Eon-Seong Lee

Department of Maritime and Logistics Management, Australian Maritime College, University of Tasmania, Launceston, Australia.

The Asian Journal of Shipping and Logistics vol. 31, no. 1, pp. 109-134.

Abstract

This paper examines the functions and challenges of dry ports development in Malaysia through 11 face-to-face interviews with dry port stakeholders. The findings reveal that Malaysian dry ports are developed to accelerate national and international business, to activate intermodalism in the nation, to promote regional economic development and to enhance seaport competitiveness. Malaysian dry ports perform the function of transport and logistics, information processing, seaports and value-added services. Challenges facing Malaysian dry ports include insufficient railway tracks, unorganized container planning on the rail deck, highly dependent on single mode of transportation, poor recognition from the seaport community, and competition from localized seaports. This paper further indicates strategies for coping with these challenges and identifies future opportunities for Malaysian dry ports development.

Key Words: Malaysian Dry Ports, Container Seaports, Extended Gateways

I. Introduction

Seaports are a subsystem of the supply chain and provide a crucial link in the transport chain that facilitates the flow of cargo. Seaports are key elements in value driven system which contribute to supply chains by creating value added services to increase the competitive advantages in the transport chain (Robinson, 2002). Modern seaports should be lean, agile and focus on service orientation, flexibility, and high integration with intermodal terminals or logistics centers to cope with the constant unchanging business environment (Paixao and Marlow, 2003). Seaports are a part of a complex system of supra system because they interact with internal and external subsystems to create an effective process within the supply chain. The complexity arises in the seaport system because it is greatly affected by changes in world trade development, supply chain and logistics tendencies, advancement in maritime transport, technological development and interactions with various players either internally or externally (Cetin and Cerit, 2010). In order to preserve competitiveness in the business, seaports may have to change the logistics and transport structure and outsource these activities. Focusing on value added logistical concepts allow seaports to become familiar with the new environment (Langen and Lugt, 2007).

Prior to containerization, the seaport system was referred to as spatial evolution whereby the system consisted of a collection of seaports in a region that would compete or cooperate with each other (Rimmer, 1967). The system focused on

competition between different terminal operators, and the interaction between hinterland and foreland (Weigend, 1956; Thomas, 1957). Technological improvements in multimodal transportation and better transportation infrastructure as a result of containerization have changed the connectivity between seaports and hinterland networks (Notteboom and Rodrigue, 2005). This is referred to as a borderless seaport because it emphasizes the functional development from a seaport to a seaport network with various degrees of formal linkages with other parties (Klink, 2000). The function of container seaports as intermodal hubs allows containers to be shipped long distances across the continent to fulfil market demand (Song, 2003). The concept of intermodal logistics and distribution networks, resulting from the changes in freight and logistics processes and challenges imposed by regional populations and freight growth, has meant that the efficiency of container seaport systems is also determined by the integration of the inland freight distribution system. Therefore, the inland component of the seaport system becomes important in shaping performance and competitive strategies of seaports.

Dry ports as part of logistics centers have become fundamental elements of local, national and international transportation systems in regions with a high volume of trade (Rodrigue et al., 2010). A dry port can be defined as an inland setting with cargo-handling facilities allowing several functions to be carried out, for example: consolidation and distribution, temporary storage, customs clearance, and the connection between transport modes. By allowing agglomeration of both private and public facilities the interaction between different stakeholders along the supply chain is facilitated (Ng and Gujar, 2009). A dry port is also known as an inland intermodal terminal directly connected to seaports with high capacity transports means, where customers can leave and pick up their standardized units as if dealing directly with a seaport (Roso, 2009). This definition has been redefined as an extended container terminal gate (Veenstra et al., 2012). A dry port is a logistics node which improves cost-efficiency, environmental performance and the quality of hinterland network connections (Woxenius and Bergqvist, 2011; Cullinane and Wilmsmeier, 2011). The various definitions indicate that the purpose of dry ports is to support seaport operations in order to enhance its competitiveness in a complex system. Dry ports assist container seaport systems by transforming seaports' static supply chains into the adaptive business networks, which increases seaport competitiveness, robustness and facilitates the supply chain given the constant change in the global transport system (Vervest and Li, 2009).

Changes in global trade, logistics and supply chain systems have also had an impact on the Malaysian seaport system. Major container seaports such as Port Klang, Penang Port and Johor Port have experienced an increase in container traffic, with an annual growth rate of 14.8%, 6.94% and 8.64% respectively for the period 2008-2011 (Ministry of Transportation Malaysia, 2012). For example, in 2011 Port Klang handled 9.6 million TEUs and was ranked thirteenth amongst the top fifty container ports in the world, whereas Pelabuhan Tanjung Pelepas (PTP, the operator of Johor Port) was seventeenth amongst the world's top container ports with 7.50 million TEUs, a growth of 15.38% over 2010 (World Shipping Report, 2013). To accommodate the growth of container traffic in Malaysia, container seaports need to improve their capacity, functions and services to supply chain networks and direct further development of existing networks (Rodrigue, 2008).

Dry ports in Malaysia have been developed since the 1990s and have increasingly played an active role in facilitating the nation's trade, enabling goods to be transported and distributed from seaports to their final destination. The development

of dry ports is crucial in dealing with the dynamic changes in freight and logistic processes. Efficient and sophisticated value added services are essential to enhance the dry port's performance (Tsilingris and Laguardia, 2007). Malaysian dry ports have been positioned as the main extended gateways of major container seaports as a result of increasing throughput of container seaports. Nazery et al. (2012), revealed that most of the dry ports in Malaysia have insufficient infrastructure and facilities, thus their support for the adjacent seaports is limited. This is evidenced by a recorded low volume of containers handled by dry ports. Additionally, the services provided by Malaysian dry ports are not sufficient to fulfil customers' needs. According to Nazery et al. (2012), the distance from seaports, accessibility to the seaport, access to road and rail systems, linkage between and within modes of transport as well as unused railway tracks because of insufficient planning are some of the problems of Malaysian dry ports operation.

Owing to the limited academic research into the functions of Malaysian dry ports within the container seaport system, this paper investigates the role of Malaysian dry ports and the challenges they face from a container seaport system's point of view. This paper, through face to face interviews with important stakeholders, provides a clear picture of the development and operation of Malaysian dry ports and explores the current situation of dry ports in the complex seaport system. Strategies suggested by interviewees for coping with the challenges of operational efficiency in the seaport system are also addressed.

II. Experiences of Worldwide Dry Ports Development

Many countries have developed dry ports to facilitate trade and cargo flows between seaports and final destinations. Based on the experiences of dry port development in Europe, Africa, America, and Asia, this section reveals the development of the dry port concept and reviews the function of dry ports in the seaport system, the challenges faced by these dry ports and the strategies for improvement. In Europe, Swedish dry ports play a significant role in the seaport system (Bergqvist et al., 2010) by being space providers, container buffering zones, intermodal transports zones, and value added logistics service providers to the containers (Woxenius and Bergqvist, 2010). In the Scandinavian region, dry ports have faced challenges such as the location of dry ports not being in the East-West corridor, a lack of skilled laborers, low capacity of rail links and limited length of rail tracks (Viser et al., 2009). Some strategies have been identified to harmonize the Scandinavian dry port operations. For example, the introduction of combined infrastructure such as road and rail networks increases freight volumes to seaports and at the same time reduces the traffic congestion in seaports. Scandinavian dry ports also introduce creative, innovative and competitive services to attract stakeholders to use their facilities (Bergqvist et al., 2010). A different approach has been implemented in Valencia dry port, Spain. This dry port introduces a Port Community System (PCS) to integrate different stakeholders in seaport operations and maritime transport by giving support, and managing information and administrative procedures in the dry port operation. The PCS covers the information from various stakeholders, particularly shippers, rail operators and seaports. This system produces an integration and coordination between dry ports and their clients (Dotoli et al., 2010).

Dry ports play a very important role in the African maritime industry because there are many landlocked countries in Africa and the establishment of dry ports is crucial to inland regions (Arvis et al., 2010). 'Forward-Ports' is a general term given to

African dry ports because most of the dry ports act as cargo delivery stations with high speed and security. These forward ports not only execute the role of intermodal terminal but also balance the traffic between rail and road transportation, providing customs and border management services (Ahamed, 2010). However, Raballand et al. (2008) indicated that many dry ports are not well operated because of insufficient logistics infrastructure and inefficient services to the customers, which have led to poor connectivity to seaports and delays in container clearance. For example, a dry port in Egypt was unable to provide sufficient infrastructure, maintenance, and systematic legislative and institutional processes to optimize their involvement in the seaport system (Vandervoort and Morgan., 1999). Therefore, governments in African countries, especially in Nigeria, South Africa and Tanzania, have initiated a strategy of upgrading the logistics infrastructure to improve dry port operations, aimed at enhancing the connectivity to seaports and reducing container dwelling time from 15 days to an international standard of 7 days (World Bank, 2008;Ahamed, 2010). This strategy increases the connectivity of seaports to their clients, smoothes cross border trade, and allows investment from private sectors to enhance trade competitiveness in Africa (Raballand et al., 2008).

In America, dry ports facilitate seaport container traffic flow and provide competitive inland services such as high level inland connectivity and seaport capacity expansion (Rodrigue, 2011). They act as regional distribution facilities with the capacity to segregate containers for various distribution centers through various modes of transportation (Bruce et al., 2013). For example, Chilean dry ports perform as logistics platforms in the logistics chain and have an extended capacity to accommodate the largest volume of container traffic and highest value of international trade in South America (Aversa et al., 2005). Other dry ports such as Virginia Dry Port in the United States and Los Andes Dry Port in Chile overcome issues of over congestion, increase the application of modal shifts and generate sufficient container volume to seaports (Bruce et al., 2013).

In China, fierce competition among seaports places pressure on the efficiency of the supply chain network, and hinterland connection is regarded as a major determinant for seaport competitiveness (Wang, 2009). In addition, in coastal cities, a strong need for urban development due to growing populations has limited the availability of land for seaport expansion. Therefore, Chinese seaport-based dry ports were developed for the purpose of capturing more cargo flowing along the inland supply chain and to relieve capacity constraints at seaports (Zhong, 2010; Beresford et al., 2012).The government invests in roads and rail networks to enhance the connectivity between seaports and dry ports to increase the volume of containers and to promote regional economic development (Qin, 2010).

In India, dry ports are known as container freight stations and inland container depots. The emergence of Indian dry ports has enhanced seaport competitiveness by reducing traffic congestion, improving Logistics Performance Index (LPI) and increasing capacity (UNESCAP, 2006). The challenges of Indian dry ports include insufficient interactions between the stakeholders which provoke extra costs, overlaps in the schedules which can create bottlenecks in infrastructure planning. Hence, the strategies of information sharing between stakeholders, integrated facility sharing and coordination of facility development have been proposed to assist Indian dry ports in reducing unnecessary costs and generating a smooth flow in the daily schedule (Sahay and Mohan, 2009).

In general, challenges faced by dry ports in different countries vary. Therefore, the strategies to overcome those challenges may be different, but they have to ensure that the dry ports are able to fit into the complex seaport system (Vervest and Li, 2009). Dry ports must improve the interaction of various stakeholders operating with different objectives in the container distribution network, which will ultimately contribute to seaport competitiveness (Roso et al., 2009; Padilha and Ng, 2011).

III. Malaysian Perspective in Dry Ports Development

In Malaysia, four dry ports are currently operating to support seaport container terminal operations. The first dry port is Padang Besar Cargo Terminal (PBCT), which has been operating since 1984. PBCT encourages cross border trade between Thailand and Malaysia because it is strategically located between these two countries. PBCT's main role is to handle containers to and from Southern Thailand by train and road, which are then shipped through Penang Port and Port Klang. Almost 90% of containers originating from Southern Thailand were transported by road to PBCT and shipped through Penang Port (UNESCAP, 2006).

Ipoh Cargo Terminal (ICT), the second dry port in Malaysia, was established in 1989 and is located at a strategic inland location between Port Klang and Penang Port. ICT is a well-known dry port and helps to provide import and export services for a range of industries in Northern Malaysia. The third Malaysian dry port is Nilai Inland Port (NIP), established in 1995 and located between Port Klang and Johor Port. NIP offers services, facilities and space to support the growing container volumes at Port Klang in the central region and Johor Port in the south. NIP takes advantage of its strategic location in the center of peninsular Malaysia to offer shippers the facilities and provide the necessary documentation for moving goods to and from seaports. This dry port has attracted many customers to use its services as a one-stop logistics center and a transshipment center to increase the competitiveness of the major seaport operation.

The fourth Malaysian dry port is Segamat Inland Port (SIP), which commenced operation in 1998. SIP offers facilities and services to manufacturers and traders in the southern region of peninsular Malaysia. The establishment of this dry port has made Johor Port and Port Klang the preferred ports of entry instead of going through neighboring ports. In fact, SIP has been developed as a national load center and transshipment hub (UNESCAP, 2006; Ministry of Transportation Malaysia, 2012). Each dry port has significant roles and responsibilities to container terminals in Malaysia as well as in the international transshipment of containers, providing feeder business to and from South Asia, Cambodia, Thailand and Vietnam. The Malaysian railway system provides rail freight infrastructure to support the movement of freight to and from seaport container terminals (Malaysian Railway Company, 2009). Table 1 summarizes the information on Malaysian dry ports.

IV. Methodology

In order to achieve the aim of this paper, semi-structured face-to-face interviews were conducted to collect information on the roles of Malaysian dry ports in the container seaport system and the challenges they face. A total of 14 potential participants in higher managerial positions and of sufficient knowledge in dry ports were invited for interview. They were selected from Malaysian dry ports, container seaport authorities and operators, and government bodies. However, due to

individuals' availability and other constraints, this number reduced down with the consequence that 11 interviews were completed. The interviewees included four seaport managers, four dry port managers, two government managers and a manager from Malaysian railway. On average, each interview took about 30-40 minutes. The interview questionnaire consisted of three parts, i.e. the role of dry ports in the container seaport system, the challenges of dry ports and the strategy to overcome the challenges faced by Malaysian dry ports with an overall aim to enhance seaport competitiveness.

<Table 1> Dry ports in Malaysia¹⁾

Dry ports	Mode of container distribution	Seaports connection	Location	Investment
Ipoh Cargo Terminal (ICT)	Road and rail	Port Klang, Penang Port & Johor Port	181 km south of Penang Port and 250km of Port Klang	Private & government
Nilai Inland Port (NIP)	Road	Port Klang & Johor Port	50 km South of Kuala Lumpur and 93 km from Port Klang	Private & government
Padang Besar Cargo Terminal (PBCT)	Road and rail	Penang Port & Port Klang	158 km north of Penang Port and 588 km north of Port Klang	Private & government
Segamat Inland Port (SIP)	Road and rail	Port Klang & Johor Port	212 km south of Kuala Lumpur and 188 km north of Port Tanjung Pelepas	Private & government

The data collected was analyzed using a systematic design based on the grounded theory method. This method is suitable for a case study as it enhances the construct validity of qualitative research through a clearly specified operation procedure (Parker and Roffey, 1997). A systematic design is used because it generates themes from data analysis through familiarization, reflection, open coding, axial coding and selective coding (Creswell, 2008). The use of qualitative software for data interpretation is not advisable because the software is unable to detect theoretical sensitivity, which is very important during interview sessions (Suddaby, 2006). Data categorization or themes have been generated using a systematic design, which is important to focus the meaning in the research context as well as being understandable by an outside audience (Gough and Scoot, 2000).

V. Results and Discussions

In the first part of the interview questionnaire, participants were asked about their perspectives on the role of dry ports in Malaysia, including definition and classification, objectives and functions. The results are discussed in sections 1, 2 and 3 respectively below. Subsequently, the results in relation to the second and third part of questionnaire, i.e. challenges and strategies of Malaysian dry ports, are addressed

1) Compiled by authors

in 4 and 5. Discussions are based on categories or themes which have been developed through the data analysis process. All those codes are connected to explore the role of Malaysian dry ports in the container seaport system and provide a clear picture on the current situation for Malaysian dry ports.

1. Definition of Dry Ports in Malaysia

Based on the responses from the interview participants, three main themes have been identified from nine sub-categories to define Malaysian dry ports (Table 2). The three main types that define the functionality of Malaysian dry ports are regional intermodal terminals, an extended seaport and interface terminals. All participants defined dry ports in Malaysia as regional inland ports connecting seaports and hinterland through intermodal means. They also stated that Malaysian dry ports were established to assist seaport activities and to help manufacturers direct their containers to and from seaports in the shortest time and at the lowest cost in order to enhance seaport competitiveness. Dry ports in Malaysia are considered similar to seaports, but are located in urban areas, providing sufficient volume of containers to the seaports through various modes of transportation. The participants emphasized that dry ports are effective in their operation if they are located near manufacturing areas or industrial parks to support the container movement to and from a seaport without any hindrances such as traffic congestion or delays in container clearance. In addition, the utilization of dry ports by manufacturers or other stakeholders reduces the pressure on port facilities and alleviates capacity constraints faced by major Malaysian seaports.

<Table 2> A summary of definition of Malaysian dry ports²⁾

Type	Functionality
A regional intermodal nodes	<ul style="list-style-type: none">• Regional inland ports• Inland transshipment ports• Inland terminals
An extended seaport	<ul style="list-style-type: none">• Assist seaport activities to provide time and cost advantage for the container freight
An interface terminal	<ul style="list-style-type: none">• Connect various modes of transportation• An interface between seaports and manufacturers

2. Objectives of Malaysian Dry Ports in Seaport Systems

The objective of dry ports is important as it directs the dry ports’ role. The participants’ responses to this interview question were analyzed and consequently five main objectives (themes) of dry ports have been identified (Table 3). The majority of the participants (91%) expressed that accelerating national and international business is the most important objective of Malaysian dry ports. For example, Perlis, a Malaysian state located in the northern tip of Peninsular Malaysia, is highly dependent on agricultural products but is economically less developed. PBCT has high investment in this state and promotes the development of cross-border transactions. This is evidenced by an increase in the volume of containers from southern Thailand to Penang Port since 2000. The volume of containers from

2) Compiled by authors

southern Thailand via PBCT increased from 48,239 TEUs in 2000 to 100,371 TEUs in 2013. PBCT contributes 40% of the total containers to Penang Port (the data is obtained from an interviewee).

Manufacturers from southern Thailand prefer using PBCT as an intermediate to ship their goods to Penang Port rather than Bangkok Port because the distance between southern Thailand to Penang Port is nearer than that to Bangkok Port and there is shortage of capacity and capability to transport containers from southern Thailand to Bangkok Port. The inland transport service and infrastructure are better than that in Thailand. The second important objective of Malaysian dry ports, with 82% of interviewees' perspective, is to activate intermodalism in the country as they become transport nodes linking seaports and the regions through multimodal transport. Other objectives, such as improving seaport competitiveness and boosting regional economic development were also considered by 64% of the interviewees. In addition, the participants expressed that Malaysian dry ports can contribute to the upgrading of transport infrastructure and they can create employment opportunities through investment. Six of the eleven participants (55%) stated that enhancing the effectiveness of national port policy was as an objective of dry port development in Malaysia.

<Table 3>Objectives of Malaysian dry ports³⁾

Priority	Objectives
1	Accelerate national and international business
2	Activate intermodalism in the nation
3	Improve seaport competitiveness
4	Boost regional economic development
5	Establish Malaysian port policy

3. Functions of Malaysian Dry Ports

The data analysis generated four themes in relation to the functions of dry ports, including transport and logistics function, information processing function, seaport function and value added service function. Most of the interview participants (91%) stated that dry ports in Malaysia performed the transport and logistics function by acting as intermodal nodes linking seaports and manufacturers in different regions. For instance, ICT connects three seaports Port Klang, Penang Port, Johor Port with various manufacturers in Perak state, Kedah state and Penang state. ICT divides its logistic area into three major zones according to distance. The perimeter of the first zone is less than 20 kilometers from ICT, while the second zone is between 20 and 30 kilometers, and the third zone is more than 30 kilometers. The total number of containers handled by ICT in 2013 was 40,100 TEUs compared to 35,000 TEUs in 2012 (the data was provided by an interviewee).

The cargo of the manufacturers/customers in the respective zone can be transported to and from the seaport via ICT through road and rail transport. ICT provides 6 train trips per week to Port Klang with a capacity of 480 TEUs per week (the data is obtained from an interviewee). Malaysian dry ports distribute a significant volume of containers to Malaysian seaports. For example, 50% of ICT containers are transported to Port Klang, Penang Port and Johor Port, while 70% of the containers in NIP head to Port Klang and Johor Port. Seaport competitiveness can be enhanced by a reduction in container dwelling time in terminals, low inland transportation costs and

3) Compiled by authors

high connectivity to the seaports. Thus, the function of dry ports as ‘connecting stations’ between customers and seaports has a significant effect on seaport competitiveness (Bichou and Grey, 2005).

The respondents state that Malaysian dry ports perform information processing functions such as custom clearance centers, immigration centers and police departments for domestic and cross border trades. They say that Malaysian dry ports also perform some of the seaport functions. They serve not only as warehouses for manufacturers, but also as container storage areas and customs clearance centers assisting seaports in managing import and export procedures. Consequently, Malaysian seaports are able to focus on their primary activities such as container loading/unloading and transshipment. The two functions that dry ports perform can benefit seaports by leaving them more space to accommodate cargo and allowing seaports to increase revenue by diversifying their business. For example, the interviewee from Port Klang expressed that Port Klang would have more spaces to support the National Vehicle Transit Centre at the seaport if dry ports could play the above mentioned functions, and as a result more income could be generated from the center.

Some participants expressed that dry ports perform the function of value added services such as consolidation and deconsolidation centers and distribution parks. For example, in NIP, the service of consolidation and deconsolidation is provided to the nearest states such as Malacca, South Selangor, Seremban and Northern Johor. These states are known as manufacturing zones for electronics parts, food and agricultural products. The credibility of NIP providing space to the containers from another state and channeling it to the main seaport reduces delivery time and freight costs. Manufacturers from these regions utilize the services provided by NIP to gain time and cost advantages. Other services such as customs services, client’s facilities, brokerage, forwarding agents and transportation are highly required by stakeholders. Additionally, the Lost and Pilferage Policy initiated by NIP promises safety and security to the content in the containers. In ICT it also performs as a value added service terminal such as consolidation terminal, capturing containers flowing along the inland supply chain. It can operate on a just-in-time basis to decrease the freight costs of the manufacturer and enhance seaport competitiveness by reducing traffic congestion either from trucks or containers.

4. Challenges of Malaysian Dry Ports

The analytical results include five main themes related to major issues of Malaysian dry ports: transportation infrastructure and operations, container planning, competition, location and community. From a transportation perspective, insufficient railway tracks are the main challenge facing Malaysian dry ports. Most of the interview participants from seaport authorities and operators stated that the Malaysian rail system provides sufficient wagons but insufficient tracks to transfer containers from dry ports to seaports and vice versa. Participants from Penang Port, Port Klang, Johor Port, ICT, SIP and PBCT had the same view on this matter. For example, PBCT is facing space constraints due to the increasing number of inbound cross-border containers. The number of containers received from the southern Thailand catchment area is increasing and hence there is a need for faster clearances/movements of container at PBCT to allocate more space for additional containers. However, a single railway track is inefficient to carry a high volume of containers to Penang Port from PBCT.

In contrast to PBCT, respondents noted that NIP has no rail service to seaports. According to the interviewee from NIP, the volume of containers handled by NIP is not sufficient to be transported by rail. Currently, containers are transported via road haulage rather than rail between NIP and Port Klang because of the short distance. The interviewee further indicated that NIP handled 15,000 TEUs in 2000 and this increased to 175,000 TEUs in 2013. NIP currently has a sufficient capacity (500 trucks) to accommodate containers transported by road. The use of road haulage as the main mode of transportation produces more environmental issues such as air pollution and noise pollution and increases traffic congestion in the seaport area.

Moreover, states such as Seremban, Malacca, Southern Selangor and Northern Johor are affected by the heavy traffic generated by road haulage. The intensity of transport movement in a small number of locations causes terminal congestion and spills over to the surrounding regions (Janic, 2007). In summary, the issues of insufficient rail tracks or using merely one mode of transport i.e. road affect the volume of containers handled by dry ports. Consequently, Malaysian dry ports' operations are considered ineffective in attracting customers to utilize their facilities.

From a container planning aspect, it is found that the containers on the railway deck from dry ports to seaports are not organized according to their vessel schedules. Once the locomotives arrive at the seaport, seaport personnel have to spend on average an hour or more to identify the right container to the right vessel. The seaport authorities interviewed believed that inappropriate planning of container staking on the train from dry ports can cause delays in container movement and can affect the schedule integrity of vessels. Schedule integrity is affected by a delay in intermodal transportation, unexpected production delays, and a shortage of container handling equipment that leads to an empty space in the vessel and ultimately affects the competitiveness of seaports (Vernimmen et al., 2007).

The function of dry ports as a modal shift or a transportation interface terminal contributes to cooperative freight distribution networks and has a significant effect on the environment, social and economic benefits, reducing congestion and improving competitiveness in the supply chain (Wisetjindawat et al., 2007). However, the interview outcome showed that some seaport operators and shipping lines do not favor dry ports located adjacent to seaports because of competition. In fact, many shipping lines rely on seaports to provide logistics services to manufacturers who send their containers directly to the seaports, and as a result, they have to compete with dry ports to cater to the local market. This situation has occurred in the southern region of peninsular Malaysia. The intention of seaports to dominate hinterland regional markets has resulted in dry ports becoming the competitors of seaports (Rodrigue et al., 2010).

Other challenges to Malaysian dry ports from location and community perspectives include long shipment distance to seaport due to the dry ports' non-strategic locations such as away from manufacturing areas; a lack of significant recognition of their capability from seaports, manufacturers and other stakeholders; traffic congestion in the regional area; and delayed upgrading of transportation infrastructure in the regional city/town. Table 4 summarizes the challenges faced by Malaysian dry ports.

<Table 4>Challenges faced by Malaysian dry ports⁴⁾

Categories	Challenges
Infrastructure and operations	<ul style="list-style-type: none"> • Insufficient railway tracks (All) • No or limited provision of rail services (All) • Low capacity of train decks for carrying high volumes of containers (All) • Less participation of local haulages for short distance shipments (ICT) • No wide road access (All)
Container operation	<ul style="list-style-type: none"> • Inappropriate planning of container staking on the train deck resulting in time consuming for replanning/relocating the containers at seaports (PBCT) • Inefficient container transfer operations to seaports (PBCT) • No express clearance lane (All) • No facilities for empty containers (PBCT) • Insufficient spaces for accommodating increased volumes of containers (PBCT & ICT) • Frequent delays when transferring containers between transport modes (PBCT & SIP)
Competition	<ul style="list-style-type: none"> • A lack of cooperation with seaports to utilise the dry port's capability (SIP) • Reluctance of shipping lines to invest in Malaysian dry ports (SIP) • High competition with seaports in providing logistics service to dominant freight markets (SIP and PTP) • Competition between private hauliers (SIP)
Location	<ul style="list-style-type: none"> • Not located in a strategic location, resulting in a long shipment distance (SIP) • Located in the non-profitable zone for short distance distribution (ICT) • Less potential for land expansion (PBCT and ICT) • Located away from the manufacturing area (SIP)
Community	<ul style="list-style-type: none"> • Communities' concerns on noise and air pollution generated by road transportation (NIP) • Traffic congestion in some regional areas (NIP and ICT) • A lack of exposure of dry ports' credibility to the stakeholders (SIP) • The delayed upgrade on infrastructure in regional cities/towns (NIP, ICT and PBCT)

5. Strategies for Improving Malaysian Dry Port Operations

This section discusses several strategies for enhancing the integration of dry ports into the seaport system and further improving seaport competitiveness in Malaysia. A dry port is a physical infrastructure in intermodalism. It has to be well connected to transport networks to and from the seaport and regional industrial areas. Also, the ability to perform with various modes of transportation is one of the main prerequisites for dry port operation and development (Roso et al., 2009). As Malaysian dry ports have insufficient rail infrastructure and services, the Malaysian rail system may consider rail service provision in NIP to activate intermodalism in that dry port.

The combination of land haulage and train transportation could create a new dimension of container distribution in the dry port, and the volume of containers handled by NIP may be increased. Additionally, the introduction of a double track railway to increase the capacity and frequency is needed. The majority of the interviewees agreed that a double-track railway could increase the number of rail trips from dry ports to seaports and vice-versa. The presence of a double track railway would contribute to fast, high volume container movement. High frequency of train trips, just-in-time principles and easy clearance would see manufacturers utilizing these facilities in order to reduce their freight costs. Seaports maintain fast clearance to sustain a good reputation among shippers, so dry ports should have sufficient

4) Compiled by authors

information about the estimated time of arrival (ETA), the estimated time of departure (ETD) and the sequence of the container on the train to ease the loading/unloading process. One interviewee estimated that the double track system could enhance train capacity from 80 to 100 TEUs and subsequently reduce the container's transit time from seven hours to four hours.

The participants stated that the involvement of local haulers to transport containers within a short distance is highly valued by dry port operators. For example, an interviewee stated that ICT faces a challenge to direct some of the containers to zone 1, less than 20 kilometers from the dry port, because most of the haulers prefer long trips to zone 2 or 3, i.e. 20-30 kilometers and above 30 kilometers from the dry port. Therefore, interviewees suggested that dry port operators should possess their own transport for container distribution in zone 1. As investment in dry port infrastructure or facilities enhance the cooperation for dry port operations among the stakeholders (Qin, 2010), ICT's investment in road transport for container distribution would fulfil the need of its clients.

Seaport operators and the community should recognize dry ports as valuable components in the Malaysian container seaport system. Moreover, stakeholders' understanding of dry ports' operations will generate good team work between them. Seaport operators should consider dry ports as co-operators rather than competitors as they supplement seaports' functions. In fact, the assistance of dry ports to seaports can eliminate the competition among seaports (Rodrigue et al., 2010). For example, in one of the Malaysian container seaports, about 70% of its throughputs were transshipments. To maintain a competitive position as a transshipment container seaport, intermodal linkages of seaports to major consumer markets, diversity of other modes and access to inland transportation are important (Park and Min, 2011).

Therefore, assistance from dry ports is needed to enhance Malaysian seaport competitiveness and to compete with the other international neighboring seaports. Seaport reclamations are one of the main issues that keep haunting seaports due to the increase of containers in the maritime industry. Additional space is needed for container seaports to achieve a higher level of productivity and address the concerns of increasing demand from seaport stakeholders (Pellegram, 2001). Many seaports in Malaysia have undergone land reclamation processes within the past decade especially in Port Klang and Penang Port. The existence of dry ports may reduce port reclamation in the future because dry ports are able to provide seaports with the space to accommodate the growing volume of containers.

Of interest is that some interviewees suggested that Malaysian dry ports could act as Barter Trade Ports, specializing in handling import and export of cargoes such as grain, coal, light vehicles, sugar, and others from Indonesia, Thailand and the Philippines. The aim of Barter Trade Ports is to encourage inter-Asian trade which is very low, on average contributing between 18-24 % of the total trade. The participants believed that shifting the Barter Trade Port function to Malaysian dry ports may increase inter-Asian trade and create momentum in the existing cooperation between the regions such as Singapore-Riau-Indonesia (SIJORI), Indonesia-Malaysia-Singapore-Golden Triangle (IMS-GT) and Brunei-Indonesia-Malaysia-Philippines-East Asian Growth Area (BIMP-EAGA) (Dollah and Mohamad, 2010).

Another strategy recommended by the interview participants to promote dry port operations in the seaport system is the provision of multiple value added services to customers. Most seaports in Malaysia urge dry ports to diversify their services with sufficient infrastructure. Table 5 shows interview participants' views on the fundamental requirements for Malaysian dry port operations, within which about 70%

of those requirements were suggested by dry ports' main clients. They suggested that Malaysian dry ports should possess three requirements to improve operations.

As most dry ports in Malaysia lack infrastructure to attract and ensure a smooth flow of inbound container traffic in the future, the first requirement is operational infrastructure consisting of primary requisites, important requisites, differentiating requisites and miscellaneous requisites. The requirement of operational infrastructure is to focus on the facilities that enable dry port operations. Moreover, advanced logistics services are virtually absent in most of the dry ports, thus Malaysian dry ports need advanced facilities to provide value added services to satisfy customers' needs. The second requirement is personnel, as a reliable labor force is essential to execute operational procedures. This requirement is split into three major groups including warehouse staff, yard staff and safety and security staff. The final requirement is capital infrastructure, specifically the resources needed to operate infrastructure such as land, rail tracks, roads, warehouses, yards and others.

<Table 5> Requirements for Malaysian dry port operations⁵⁾

Operational infrastructure requirement	
Primary requisites	Container yard, customs, rail access truck, rail siding, express clearance lane, immigration & quarantine office.
Important requisites	Weigh bridge, truck parking bay, internal roads, cargo consolidation yard, external and internal road accessibility, and stacker cranes
Differentiating requisites	Bonded and non-bonded warehouse, stuffing and unstuffing yards, empty container and repair yards and clearance agents office
Miscellaneous requisites	Police station, fire station security office and cafeteria.
Personnel requirement	
Warehouse staff	Bonded and non-bonded
Yard staff	Container yard, stuffing and un-stuffing, consolidation, container repairs, physical check officers, express clearance lane officers, truck parking bay managers and stacker crane operators.
Safety and security staff	Customs officers, immigration and quarantine officers, security officers, police officers and fire fighting officers
Capital infrastructure requirement	
Land area, rail siding, rail access tracks, warehouses, weigh bridge, yards, customs office, immigration and quarantine office, internal roads.	

VI. Conclusion

Through face to face interviews with Malaysian seaport authorities, seaport operators, government officers and dry port operators, this paper presents the definition of dry ports in the Malaysian seaport system and explores the objectives and functions of Malaysian dry ports. The challenges confronting dry ports have been investigated, including insufficient railway tracks, unorganized container planning on the rail deck, use of a single mode of transportation, less recognition from seaports about the credibility of dry ports, competition from seaports and location. Several strategies have been suggested by interview participants for improving the reliability

5) Compiled by authors

of dry ports and providing possible resolutions to those challenges. These include an acknowledgement from seaports on the function of dry ports and promoting cooperation, activating the concept of intermodalism in container delivery, well-organized and systematic container planning on the railway deck and an introduction of a double track railway system to increase train frequency and capacity and providing value added services with sufficient infrastructure. The recommendation to Malaysian dry ports is to develop intermodal supply chains and logistics networks and to improve the competitiveness of seaports by enhancing seaport capacity, better hinterland networks, increased seaport-hinterland accessibility and seaport reliability, especially in modal shifting and schedule integrity. Furthermore, the development of dry ports in Malaysia amplifies the capacity of seaports to accommodate significant container traffic and throughput from foreland and hinterland.

Looking into the future, the opportunities for Malaysian dry ports are bright, especially the implementation of Malaysian Cabotage Policy, promoting the movement of containers between two domestic ports operated by Malaysian registered vessels through Port Klang. This policy will result in more containers being transported through feeder vessels to and from east Malaysia and will create more opportunities for dry ports to develop their role in the seaports system, which in turn will enhance the seaports ability to handle the high volume of domestic containers. Another reason for developing dry ports in Malaysia is that they can offer an opportunity to reduce traffic congestion in the Malacca straits. Containers from Port Klang, Penang Port and Johor Port can be distributed through the Trans Asian Railway network which connects Singapore, Malaysia, Thailand, Cambodia, Vietnam, Laos, Myanmar and Kunming in China. This connection known as Singapore-Kunming Rail Link (SKRL) will allow shippers to use Malaysian seaports as transit hubs for containers destined for Singapore and China through the Malaysian dry ports network.

Given these opportunities, Malaysian dry ports should pursue better efficiency to support container seaports and enhance seaports' competitiveness. Therefore, to overcome the current challenges facing dry ports is critical, both in terms of capital and operational infrastructure. Importantly, coordination and collaboration among dry ports, seaports and other important stakeholders can provide mutual benefits and promote Malaysian domestic and international trade.

REFERENCES

- AHAMED, Y. (2010), *"Final report of feasibility study of dry ports, "Economic Commission for Africa, United Nation, pp. 379-416.*
- ARVIS, J. F., MUSTARA, M. A., OJALA, L., SHEPPERD. L and SASLAVSKY, D. (2010), *"The logistics performance index and its indicator," World Bank and Turku School of Economics, Finland, Washington D.C., pp. 53-65.*
- AVERSA, R., BOTTER, R. C., HARALAMBIDES, H. and YOSHIZAKI, H. T. (2005), *"A mixed integer programming model on the location of a hub port in the east coast of South America," Journal of Maritime Economics & Logistics, Vol.7, No.1, pp. 1-18.*
- BERESFORD, A.K.C, PETIT, S. XU, Q. and WILLIAMS, S. (2102), *"A study of dry port development in China," Journal of Maritime Economic and Logistics, Vol. 14, No.1, pp.73-98.*

- BERGQVIST, R., WOXENIUS, J. and FALKEMARK, G. (2010), "Establishing intermodal terminal," *Transportation Research*, Vol. 3, No. 3, pp. 285-302.
- BICHOUK and GRAY, R. (2005), "A critical review of conventional terminology for classifying seaports," *Transportation Research Part A: Policy and Practice*, Vol. 39, No.1, pp. 75-92.
- BRUCE, L., MILLER, C., LIBBY, O., and RITCHEY, B. (2013), "*Observation on the potential for dry ports terminal developments in United States*," Ashgate, England.
- CETIN, C. K., and CERIT, A. G., (2010), "Organisational effectiveness at seaports: A system approach," *Maritime Policy and Management*. Vol. 37, No. 3, pp. 195-219.
- CRESWELL, J. W. (2008), "*Educational research: Planning, conducting and evaluating quantitative and qualitative research*," 3rd edn, Kevin M. Davis, New Jersey.
- CULLINANE, K.P, and WILMSMEIER, G. (2011), "The contribution of the dry port concept to the extension of port life cycles" in J.W. Bose (Ed.), *Operations Research Computer Science Interfaces Series*, Vol. 49, Heidelberg: Springer, 359–380.
- DOLLAH, R., M, and MOHAMAD, A.M, (2010), "Malaysia–Indonesia barter trade: Opportunities and challenges," *Journal of Southeast Asian Studies* Vol.12, No.1, pp. 411-419.
- DOTOLI, M., FANTI, M. P., MANGINI, A. M., STECO, G. and UKOVICH, W. (2010), "The impact of ICT on international transportation systems: A modelling approach," *Journal of Engineering Practice*, Vol. 18, No. 6, pp. 893-903.
- GOUGH, S. and SCOTT, W. (2000), "Exploring the purposes of qualitative data coding in educational enquiry: insights from recent research," *Educational Studies*, Vol.26, pp. 339–54.
- JANIC, M. (2007), "Modelling the full costs of an intermodal and road freight transport network," *Journal of Transportation Research Part D: Transport and Environment*, Vol. 12, pp. 33-34.
- KLINK, H. A. (2000), "Optimisation of land access to sea ports," *Proceedings of the land access to sea ports*, European Conference of Ministers of Transport, pp. 10-11, Rotterdam.
- LANGEN, D. and LUGT, L. M. (2007), "Government structure of port authorities in the Netherlands: Devolution, port governance and port performance," *Journal of Transportation Economics*, Vol. 17, No. 5, pp. 109-137.
- MALAYSIAN RAILWAY COMPANY, (2009), "*Malaysia railway performance from the logistics point of view*," pp. 16-20.
- MINISTRY OF TRANSPORTATION MALAYSIA, *Annual Report*. (2012), "*Malaysian port and shipping towards the globalisation*," pp. 31-36.
- NAZERY, K., ANG, M. and HASAN, E. C. A. (2012), "Secondary ports in Malaysia: Unsung heroes," *Maritime Institute of Malaysia*, Vol. 19, No.1, pp. 6-15.
- NG, A. K., and GUJAR, G. C. (2009), "Government policies, efficiency and competitiveness: The case of dry ports in India," *Transport Policy*, Vol.16, pp. 232-239.

- NOTTEBOOM, T. and RODRIGUE, J. P. (2005), "Port Regionalization: Towards a new phase in port development," *Journal of Maritime Policy and Management*, Vol. 32, No. 3, pp. 297-313.
- PADILHA, P. and NG, A. K. (2011), "The spatial evolution of dry ports in developing economies: The Brazilian experience," *Journal of Maritime Economics & Logistics*, Vol. 18, No. 4, pp. 519-529.
- PARK, B. I. and MIN, H. (2011), "The selection of transshipment ports using a hybrid data envelopment analysis/analytic hierarchy process," *Journal of Transportation Management*, Vol.22, No.1, pp. 116-131.
- PAIXAO, A. C. and MARLOW, P. B. (2003), "Fourth generation ports: A question of agility?" *International Journal of Physical Distribution and Logistics Management*, Vol. 33, No. 4, pp. 355-376.
- PARKER, L. D. and ROFFEY, B. H. (1997), "Back to the drawing board: revisiting grounded theory and the everyday accountant's and manager's reality," *Accounting, Auditing & Accountability Journal*, Vol. 10, No. 2, pp. 212-247.
- PELLEGRAM, A., (2001), "Strategic land use planning for freight: the experience of the Port of London Authority 1994-1999," *Transport Policy*, Vol. 8, pp. 11-18.
- QIN, L. Z. (2010), "The development the dry ports in China and countermeasure," *Journal of Port Economy*, Vol. 9, No. 22, pp. 21-23.
- RABALLAND, G. F., KUNAKA. C., and GIERSSING, B. (2008), "The impact of regional liberalization harmonization in road transport services: A focus on Zambia and lesson for land locked countries," *World Bank Policy Research Working Paper World Bank*, Washington D.C., pp. 623-644.
- RIMMER, P. J. (1967), "The search for spatial regularities in the development of Australian seaports," *Journal of Human Geography: Series B*, Vol.49, No.1, pp. 42-54.
- ROBINSON, R. (2002), "Ports are elements in value driven chain system: the new paradigm," *Maritime Policy and Management*, Vol. 29, No. 3, pp. 241-255.
- RODRIGUE, J. (2008), "The thruport concept and trans modal rail freight distribution in North America," *Journal of Transport Geography*, Vol.16, pp. 233-246.
- RODRIGUE, J. P. (2011), "The functional relations between third party logistics and intermodal transport systems," *Proceedings of the land translog conference*, Puerto Varas, Chile, pp. 86-112.
- RODRIGUE, J.P., DEBRIE, J., FRÉMONT, A., and GOUVERNAL, E. (2010), "Functions and actors of inland ports: European and North American dynamics," *Journal of Transport Geography*, Vol.18, pp. 519-529.
- ROSO, V. (2009), "Factors influencing implementation of a dry port," *International Journal of Physical Distribution & Logistics Management*, Vol.38, No.10, pp. 782-798.
- ROSO, V., WOXENIUS, J. and LUMSDEN, K. (2009), "The dry port concept: connecting container seaports with the hinterland," *Journal of Transport Geography*, Vol.17, No.5, pp. 338-345.

- SAHAY, B. S. and MOHAN, R. (2009), "3PL: An Indian perspective," *International Journal of Physical Distribution and Logistics Management*, Vol.37, No.7, pp. 528-606.
- SONG, D. W. (2003), "Port co-operation in concept and practice," *Journal of Maritime Policy and Management*, Vol.30, No.1, pp. 29-44.
- SUDDABY, R. (2006), "From the editors: what grounded theory is not," *Academy of Management Journal*, Vol. 49, No.4, pp. 633-642.
- THOMAS, B. (1957), "Railways and ports in French and West Africa," *Journal of Economic Geography*, Vol. 33, No. 1, pp. 1-15.
- TSILINGRIS, P. S. and LAGUARDIA, C. T. (2007), "Dry Vis-a`-Vis water ports: Partners or competitors? The case of Spain," *Proceedings of the International Scientific Conference*. University of the Aegean, Chios, Greece, pp. 39-55.
- UNESCAP, (2006), "*Logistics sector developments: planning models for enterprises and logistics clusters*," Economic and social commission for Asia and the Pacific, *United Nation, New York*, pp. 13-21.
- VANDERVOORT, C. & MORGAN, M. (1999), "Reducing transport costs of Egypt's exports," Development Economic Policy Reform Analysis Project (DEPRA), Arlington, VA, USA.
- VEENSTRA, A., ZUIDWIJKA, A. R. and ASPEREN, E. V. (2012), "Perceived benefits of improvement information exchange: a case study on rail and intermodal transports," *Journal of Transport Economics*, Vol. 6, No.14, pp. 14-32.
- VERNIMMEN, B., DULLAERT, W. and ENGELN, S. (2007), "Schedule unreliability in liner shipping: Origins and consequences for the hinterland supply chain," *Maritime Economics & Logistics*, Vol.9, No.10, pp. 193-213.
- VERVEST, P. and LI, Z. (2009), "The emergence of smart business networks," *Journal of Information Technology*, Vol.19, No.4, pp. 228-233.
- VISER, J., KONINGS, R., PIELAGE, B. J. and WIEGMANS, B. (2009), "A new hinterland transport concept for the port Rotterdam: Organisational or technological challenges?" *Journal of Transportation Research*, Vol.4, No. 3, pp. 201-216.
- WANG, G. (2009), "Research on inland dry ports construction and development mode," *Port Economy*, Vol. 3, No.3, pp. 27-30.
- WEIGEND, G. (1956), "The problem of hinterland and foreland as illustrated by the port of Hamburg," *Journal of Economic Geography*, Vol. 32, No.1, pp. 1-16.
- WISSETJINDAWAT, WISINEE, SANO, K., MATSUMOTO, S. and RAOHANACHONKUN, P. (2007), "Micro-simulation model for modelling freight agents' interactions in urban freight movement," *Proceedings, 86th annual meeting of the transportation research board, Washington*, pp. 21-25.
- WORLD BANK REPORT, (2008), "Niger: Modernizing trade during a mining boom. Diagnostic trade integration study for the integrated framework program," *World Bank, Washington*, pp. 1-133.
- WORLD SHIPPING REPORT, (2013), World Shipping Council, Brussels, Belgium, pp. 10-11.

- WOXENIUS, J. and BERGQVIST, R. (2010), "Hinterland transport by rail: comparing the Scandinavian conditions for maritime containers and semi-trailers," *Journal of Transport Geography*, Vol. 16, pp. 64-78.
- WOXENIUS, J. and BERGQVIST, R. (2011), "Comparing maritime containers and semi-trailers in the context of hinterland transport by rail," *Journal of Transport Geography*, Vol. 19, No. 4, pp. 680-688.
- ZHONG, F. (2010), "Analysis of dry ports construction and development in China," *Water Transport Management*, Vol. 9, No. 28, pp. 8-13.

Paper 3: Influential factors of Malaysian dry port operations

Jagan Jeevan, Shu-Ling Chen, Stephen Cahoon

Department of Maritime and Logistics Management, Australian Maritime College, University of Tasmania, Launceston, Australia.

Proceedings of the 2015 International Association of Maritime Economists Conference, The Role of Maritime Clusters and Innovation in Shaping Future Global Trade, 24-26 August 2015, Kuala Lumpur, Malaysia.

This article has been removed for copyright or proprietary reasons.